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December 1996

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE ARMY'S LAND ACQUISITION PROJECT FOR THE NATIONAL TRAINING CENTER, FORT IRWIN, CALIFORNIA, AND PROPOSED AMENDMENT TO THE CALIFORNIA DESERT CONSERVATION AREA PLAN

TECHNICAL APPENDICES

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TECHNICAL APPENDICES

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Lead Agency

U.S. DEPARTMENT OF THE ARMY
FORCES COMMAND
NATIONAL TRAINING CENTER, FORT IRWIN
Cooperating Agency

U.S. DEPARTMENT OF THE AIR FORCE
EDWARDS AIR FORCE BASE
Cooperating Agency

Prepared by:

U.S. ARMY CORP OF ENGINEERS
LOS ANGELES DISTRICT

with

CHAMBERS GROUP, INC.
and
MICHAEL BRANDMAN ASSOCIATES, INC.

DECEMBER 1996

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APPENDIX A

LAND USE AND REQUIREMENTS STUDY

LAND - USE REQUIREMENTS STUDY

FORT IRWIN, CALIFORNIA

DEPARTMENT OF THE ARMY
HEADQUARTERS, NATIONAL TRAINING CENTER AND FORT IRWIN
FORT IRWIN, CALIFORNIA 92310-5000

REPLY TO
ATTENTION OF

20 SEP 1993

AFZJ-PT (340)

MEMORANDUM FOR Commander, Forces Command, Fort McPherson, GA
30330-6000

SUBJECT: National Training Center, Fort Irwin, Land Use Requirements Study (LURS)

1. References:

a. AR 210-21, Army Ranges and Training Land Program, dtd 21 Nov 90

b. AR 200-2, Environmental Effects of Army Actions, dtd 23 Dec 88

c. FM 100-2-1, The Soviet Army Operations and Tactics, dtd 16 July 84

d. FM 100-2-2, The Soviet Army Specialized Warfare and Rear Area Support, dtd 16 July 84

e. FM 100-5, Operations, dtd 14 June 93

f. TC 25-1, Training Land, dtd 30 Sep 91

2. Request approval of the attached National Training Center and Fort Irwin land use requirements study. This study is in support of current training land acquisition efforts. The study was prepared in accordance with Training Circular 25-1.

3. The largest maneuver event acreage requirement is the basis for training land shortfalls identified by the Army Training Land Analysis Model (ATLAM) process. On this basis the armored task force deliberate attack with an armored cavalry squadron screen against a motorized rifle battalion defense with a security zone requires 741,300 acres. The installations existing available maneuver acreage, not considering its configuration, is 330,004 acres. This leaves a maneuver area acreage shortfall of 411,296 acres. Considering the configuration of maneuver terrain at Fort Irwin, the largest single block of maneuver training land has approximately 150,000 acres. This results in a revised maneuver area acreage shortfall of 591,300 acres.

4. POC NTC is LTC Kight/LTC Everly, DSN 470-5555, commercial (619)386-5555.

FOR THE COMMANDER:

John W May

Encl

JOHN W. MAY JR.
Colonel, GS
Chief of Staff

LAND USE REQUIREMENTS STUDY
FORT IRWIN, CALIFORNIA

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PART I

EXECUTIVE SUMMARY

Preface

This Land Use Requirements Study (LURS) updates the existing 1985 LURS. Preparation is according to guidelines prescribed in Training Circular 25-1, dated 30 September 1991, and examines the availability of maneuver areas within the boundaries of the National Training Center and Fort Irwin.

Study Summary

Analysis of the factors developed in this study shows maneuver acreage available at Fort Irwin is inadequate to train Forces Command (FORSCOM) Brigade Combat Teams with their subordinate combat, combat support and combat service support battalions/task forces. These units use the National Training Center (NTC) to improve combat proficiency.

The National Training Center is uniquely equipped and organized to provide tough, realistic combined arms training according to joint operations doctrine for brigades/regiments in a mid to high intensity environment while retaining the training feedback and analysis focus at battalion/task force level. Annually, 12 brigade combat teams consisting of from four to seven battalions/task forces (averaging approximately 5000 soldiers each rotation) rotate through the NTC for intensive combat training against a world class opposing force highly trained in threat doctrine. During their 28 day stay at Fort Irwin, units experience 14 days of tactical training that includes both force-on-force and live-fire training. Units, equipped with Weapons Engagement Simulation Systems, conduct training in areas containing sophisticated data collection and recording systems that provide a record of engagements for review, analysis and use in planning and conducting training upon return to home station.

Rotation unit training at the National Training Center, as portrayed by the Army Training Land Analysis Model (ATLAM), requires 92,747,037 acre days annually. Using 168 available rotation training days, this equates to an average requirement of 552,066 training acres per rotation. The Fort Irwin military reservation encompasses 642,731 acres. To find net available maneuver acres, environmental and archeological off limits areas, land used by the NASA Goldstone Deep Space Communications Complex, permanent impact areas and land used by the Fort Irwin cantonment area, must be subtracted. Additionally, since mechanized and armored warfare is the primary focus of the NTC, we also must subtract land not suitable for tracked and wheeled vehicle maneuver (see Appendix C). The final difference is a net of 330,004 available maneuver acres. This results in an average shortfall of 222,062 acres per rotation.

The NTC has developed into a superb facility providing the most realistic combined arms training possible. The investment in instrumentation, dedicated observers/controllers and highly skilled OPFOR provides a substantial benefit in improved readiness for our Army. To maintain established standards, establish doctrinal lines of communication and provide realistic zones of operation as the lethality and mobility of modern equipment increases, additional training land must be obtained. With the increase in available maneuver acreage as outlined by this study, the NTC will continue to provide the quality of training for which it is known worldwide well into the 21st century.

PART II

THE STUDY

Section I - Introduction

1.01 General - While the National Training Center and Fort Irwin mission has grown and developed over the years, its physical boundaries have not changed. This Land Use Requirements Study seeks to find if presently available maneuver acreage is sufficient. This study will identify rotational maneuver acreage requirements for units currently using the NTC (Appendix D).

1.02 Purpose - The primary purpose of this study is to help the installation commander in assessing the adequacy of available maneuver areas for the execution of rotational training missions. It will validate the need for additional maneuver acreage at the NTC. Information contained herein is the basis for the installations preparation of land acquisition proposals. It provides the necessary documentation for review and concurrence by Forces Command, Department of the Army and others concerned with the Army's acquisition and use of land for training.

1.03 Scope - This study will analyze existing maneuver areas on the installation and determine the adequacy of these areas to meet rotational unit training requirements. This study will not consider annual training requirements for active component tenant units, reserve component and National Guard units who conduct maneuver training at the NTC.

1.04 Assumptions -

a. Fort Irwin will continue to train brigade combat teams at the National Training Center.

b. NASA's Goldstone Deep Space Communications Complex will continue to use NTC land.

c. The Leach Lake Gunnery Range will continue as a jointly used permanent impact area for the Army, Air Force and Navy.

d. The NTC will continue to conduct 12 rotations annually using the current 28 day rotation model (Appendix E).

e. Units will not conduct tactical missions repeatedly over the same terrain.

1.05 Methodology - This study uses the methods and techniques outlined in Training Circular 25-1 (TC 25-1), Training Land, dated 30 September 1991. The Army Training Land Analysis Model (ATLAM) was the model used to determine the adequacy of Fort Irwin's training land capabilities. This methodology uses the acre/day approach to determining training land adequacy.

Section II - The Threat

Information used for this portion of the study is from the National Training Center Tailored Mission Area Analysis (TMAA), dated July 1991. The purpose of this analysis was to find the immediate and future threat material system and personnel needs for the NTC.

2.01 Evolution of Weaponry and Mobility - The former Soviet Union has had a profound effect on the military organization of many third world nations. With current U.S. doctrine espousing global force projection, it is most probable that U.S. forces will face former Soviet (Russian) style organizations, tactics and equipment. Therefore, the model for the NTC's Opposing Force (OPFOR) is a Soviet style Motorized Rifle Regiment (MRR). It includes organic weapons and equipment, which we would expect to see in a mid to high intensity combat environment and selected division and army level combat resources available to a maneuvering MRR in a supporting attack role reinforcing the MRR.

The NTC OPFOR, the 32nd Guards MRR/60th Guards Motorized Rifle Division, includes the Headquarters and Headquarters Company, 177th Armor Brigade, 1st Battalion 52nd Infantry (Mechanized), 1st Battalion 63rd Armor, 87th Engineer Company, 177th Military Intelligence Company, 164th Chemical Company (Smoke), C Company 3/159th Aviation Battalion and the 177th Support Battalion (FSB). Additionally, during each rotation an infantry battalion, dismounted, and one engineer company augment the OPFOR. The infantry augmentation comes from active duty forces, RC forces, U.S. Marines and/or the Canadian Army. The U.S. Air Force provides close air support for the OPFOR through the Air Warrior Program.

The NTC OPFOR is a well trained and highly motivated unit certified in former Soviet style tactics and doctrine. It can replicate a Soviet BMP equipped MRR(+) with some equipment shortfalls. This organization includes replication of artillery, engineer, tank, air defense and reconnaissance units from division level and aviation and electronic warfare units from Army level (Appendix F). The NTC OPFOR provides air defense, maneuver, antitank, reconnaissance, artillery, helicopter, engineer and electronic warfare support on the threat battlefield.

2.02 U.S. Tactical Doctrine to Counter the Threat - Power projection is the central element of U.S. National Military Strategy. The Army contributes to this strategy as part of a joint team through force projection. Force Projection is the demonstrated ability to alert rapidly, mobilize, deploy and conduct operations anywhere in the world. Army forces fight as a combined arms team. Combined arms warfare is the simultaneous application of several elements as an integrated whole to maximize the generation of combat power. The combined arms team strives to conduct fully integrated operations in the dimensions of time, space and means. Combined arms forces operate over increasingly large areas of the battlefield. Modern combined arms warfare puts added stress on maintaining dispersed and noncontiguous formations. Advances in electronics, communications, automation, reconnaissance and surveillance, contamination avoidance, precision weapons and space technology have increased accessibility to a greater depth of the battlefield. This information-age technology has the potential to increase the tempo and lethality of modern warfare and provide the ability to disperse forces without losing the ability to mass effects.

FORSCOM armored, aviation, mechanized infantry and light infantry battalion task forces under brigade level command and control train at the NTC. Additionally, combat support and combat service support elements a Brigade Commander would expect to have available are also present. Beginning with the first quarter of fiscal year 94, divisional cavalry squadrons will begin training along with the rotational unit brigade combat team. Units training at the NTC have a varied allocation of high tech organic equipment. This includes modern tanks, air defense artillery, field artillery, anti-armor, aviation, engineer, electronic warfare, mechanized and light infantry elements. Armored reserve component combat units and elements from the U.S. Marine Corps also train as part of the rotational unit from time to time. The U.S. Air Force provides close air support for the units trained at the NTC through the Air Warrior Program.

2.03 Training Implications - The capability of NTC OPFOR units to replicate a current threat motorized rifle regiment in both equipment and tactics is great. Evolving doctrine to combat this threat requires Army units to fight dispersed over large areas of terrain. It is becoming much harder to replicate the doctrinally correct sized area of operations not only for BLUEFOR units but for OPFOR units as well. This has a negative impact on the true training value obtained by BLUEFOR units. This is particularly significant in aviation and logistics operations. Flight times/transportation times and distances from rear staging/supply points to forward deployed units or enemy positions are unrealistically reduced. They are not doctrinally correct. Attempts to achieve correct distances result in a much artificiality. BLUEFOR units must start from behind OPFOR units and avoid them to reach BLUEFOR positions. This establishes bad habits and inculcates false expectations of battlefield conditions.

2.04 Summary - Evolving doctrine places emphasis on combined arms operations over increasingly large areas of the battlefield with units dispersed over a wider area. Additionally, modernization of equipment and breakthroughs in automation, electronics and communications technology enhances weapon system lethality at extended ranges and the commander's ability to control and influence widely dispersed units. Following the philosophy that we must train as we fight, the physical confines of the NTC no longer allow the Army to meet the training needs of units training at the NTC. Leaders must practice the techniques of orchestrating the dynamics of combat. Training must simulate actual battlefield conditions as closely as possible. To meet these needs today and in the future, additional maneuver training acreage is necessary.

Section III - Unit training Requirements

To win on the modern battlefield, the Army must train in peacetime for the first battle of the next war. True readiness demands soldiers achieve and maintain maximum proficiency with their assigned weapon systems. Units must practice doctrine, tactics, techniques and procedures while the leadership practices its task of synchronizing all combat forces. Training must replicate actual battlefield conditions as closely as possible. No amount of computer driven simulation can replace actual hands-on training in the field.

3.01 Background - At its inception in 1981, the National Training Center's battle focus was at the battalion level. Doctrinally, the Army concentrated on the active defense with a European orientation. Rotational units averaged 3000 personnel and 206 combat vehicles on the battlefield.

In 1986 the NTC troop list expanded to two battalion task forces with a brigade headquarters plus attachments. In 1988 light infantry battalions began habitually participating in "armor light" rotations. This resulted in three combat arms task forces on the ground with a brigade headquarters and appropriate brigade attachments. Aviation unit training began formally during this period as well as the introduction of the first contingency operations rotation. Battle focus remained at the battalion level. Doctrinally, the Army pursued the Airland Battle philosophy orienting on offensive/defensive tactical operations with a European flavor. Units averaged 4000 personnel and 350 combat vehicles per rotation. With the introduction of the M1 Tank, M2 Bradley and AH-64 Apache the range, mobility, speed and lethality of the NTC battlefield significantly increased over previous years.

In 1993 the National Training Center transitioned to complete brigade(-) operations.. Contingency operations involving up to 8000 active duty and Reserve Component personnel are fully integrated into each fiscal years rotational schedule. Aviation training, to include involvement of the aviation brigade headquarters in the planning and execution of operations, occurs habitually. The NTC is now a brigade battlefield. Battle focus is still at the battalion level with our offensively oriented operations doctrine that has a worldwide orientation. Units average 5000 personnel and 418 combat vehicles on the battlefield per rotation.

What does the future hold for the NTC? Future doctrine will incorporate technological advances both in equipment and in the art of command and control. What new systems (Comanche helicopter, remotely piloted vehicles, M1A2 tank, Multiple Launched Rocket System, OPFOR Surrogate Vehicle, T80 tank) must the NTC be capable of supporting? What will the force (its organization) using these pieces of equipment look like? As mobility, speed, range and lethality of our systems/force increases, their area of influence also will increase. The modernization of our Army will require an increase in maneuver training land acreage to maintain a highly trained force.

3.02 Baseline Requirements -

a. Unit Level Training Acreage

1. Maneuver Areas

a. Requirements - The single mission conducted at The National Training Center requiring the greatest amount of maneuver acreage is the armored cavalry squadron advance guard mission opposed by an opposing force motorized rifle regiment forward detachment. This operation requires 611,573 acres (appendix D). Rotational training units routinely conduct brigade deliberate attack missions against a motorized rifle regiment defense and aviation attack missions that require 482,587 acres and 444,780 acres respectively. The normal brigade rotation, consisting of three maneuver task forces and an aviation attack battalion, has a gross requirement of 570,422 acres for a 14 day exercise. Rotational requirements range from a total of 731,239 acres for a three squadron (two ground squadrons and one air squadron) armored cavalry regiment to 314,224 acres for a two task force brigade with no aviation assets.

b. Actual Experience - Because of terrain configuration, the National Training Center is divided into three east - west corridors used for the conduct of task force size force-on-force tactical operations.

The northern corridor, used primarily for task force live fire operations, consists of approximately 50,000 maneuver acres. This is normally a free play live-fire exercise against a sophisticated array of computer controlled targetry replicating a variety of threat forces. It is normally not feasible to conduct regular force on force operations in this corridor. This is due to the complex target array, extensive area it covers and safety hazard due to unexploded ordnance.

The central corridor, consisting of approximately 150,000 maneuver acres, is the most frequently used area for rotational training. This is a problem in that training units gain a familiarity of the land quickly, thereby degrading training benefit. Tactically, insufficient depth and width is available for units to deploy doctrinally during combat operations. Logistics/staging areas must be positioned immediately behind deployed tactical units or positioned outside the maneuver box prohibiting effective training of combat support and combat service support assets. These shortcomings apply to the Opposing Force (OPFOR) as well. Without proper maneuver acreage, the OPFOR cannot adequately/properly portray the echelonment of forces expected. This negates the use of intelligence gathering activities/assets available to rotational training units. Positioning of OPFOR logistics areas in proximity to BLUEFOR logistics areas and conflicts in supply route useage are direct results of a lack of depth of the battlefield. This presents a serious breach in the fidelity of the training scenario. Additionally, depending on the rotational unit scenario, one third of the central corridor is not available for maneuver use due to live-fire safety fans.

The southern corridor, consisting of approximately 75,000 maneuver acres, has the same limitations as the central corridor. Several additional maneuver areas (Valley of Death, Red Lake, Hidden Valley, Arrowhead, Area B and Area C) exist, the largest containing 9000 maneuver acres. Use of these areas is primarily for staging areas for the live-fire exercise (Arrowhead) or logistics sites as appropriate.

c. Reconciliation of Differences - With an availability of only 330,004 total maneuver acres on Fort Irwin, one can easily see the severe maneuver limitations placed on training units and rotational scenario development. The necessary restriction of tactical operations to east-west maneuver corridors further amplifies these limitations. Maneuver through two or all three of the corridors is not practical. The corridors are divided from one another by untrafficable terrain (Granite Mountain separates the northern and central corridors, Tiefort Mountain separates the central and southern corridors). Because of terrain limitations effective maneuver space is, in the best case, reduced to 150,000 acres. This results in a maneuver corridor shortfall of 623,176 acres for the calvary squadron advance guard mission and a shortage of 332,587 acres and 294,780 acres, respectively, for the deliberate attack and aviation attack missions. For the installation the total shortfall is 443,172 acres. The shortfall is 152,583 acres and 114,776 acres for the advance guard deliberate attack and aviation attack missions respectively.

As mentioned earlier, repetitive use of the same terrain for multiple missions along with positioning logistics/staging areas immediately outside the maneuver box are the only methods currently available to reconcile differences in required versus available maneuver acreage. This method has a considerable impact on the training value obtained. The most logical method of reconciling maneuver acreage differences is to obtain additional training land.

2. (Live Fire) Ranges

a. Requirements - The single mission conducted during the live fire portion of a rotation requiring the greatest maneuver acreage is the armored cavalry covering force mission opposed by a motorized rifle regiment attack with a deployed forward detachment. This operation requires 266,868 acres. Habitually, during armor/light rotations, a mechanized/armor task force in conjunction with a light infantry battalion will conduct coordinated live fire operations. In this case a two task force defense in sector mission against an opposing force motorized rifle regiment attack requires 218,436 acres.

b. Actual Experience - Live fire operations at the NTC occur primarily in the northern maneuver corridor. This corridor has approximately 50,000 maneuver acres. Live fire operations are essentially free play exercises against a sophisticated, computer controlled, target array. These exercises are joint, combined arms operations incorporating Air Force elements, Army aviation units, field artillery and organic fire support. The northern live fire corridor consists of essentially two smaller corridors, Echo Valley and Drinkwater Valley, both containing approximately 25,000 maneuver acres. Separation of these two smaller corridors by mountainous pieces of terrain makes simultaneous use by one task force difficult and unsafe. Additionally, use of the western end of Echo Valley for live fire operations closes approximately one third of the central maneuver corridor because of safety fans.

c. Reconciliation of Differences - Live fire maneuver acre shortfalls are: for the armored cavalry covering force mission - 216,868 acres, for a two task force defense in sector mission - 168,436 acres and for a single task force deliberate attack mission - 43,404 acres. Only one of the two smaller corridors consisting of approximately 25,000 acres each is safe for use at any given time. This further amplifies existing shortfalls. Short of acquiring additional maneuver acreage, maneuver land shortfalls are not reconcilable. Expanding the current live fire area to incorporate maneuver acreage in the central corridor serves only to reduce maneuver acreage available for MILES force-on-force training that occurs simultaneously with live fire operations.

b. Unit - Level Training Days

1. Maneuver Areas

a. Requirements - A Standard rotation at the NTC follows a 28 day cycle (Appendix E). During this cycle, rotational units execute 14 days of continuous, joint/combined arms training in the maneuver training area. During this period, units undergo task force live fire training and force-on-force training against a highly trained OPFOR using a sophisticated Multiple Integrated Laser Engagement System (MILES) to assess casualties/losses. One, two or three task forces may combine for extended periods during the 14 day training exercise.

The NTC conducts twelve training rotations annually for a total requirement of 172 training days. One of these rotations is normally a contingency operation rotation. Depending on the scenario, this rotation may require 18 training days versus the normal 14 training days. The additional four days are necessary for early insertion of a task force as part of the contingency operation scenario.

b. Actual Experience - Using a three maneuver task force (one mechanized infantry (TF A), one armored (TF B) and one light infantry (TF C)) unit as the vehicle by which to dissect the rotational training exercise, a breakout of actual maneuver training days is below (see also Appendix F):

1. Training day 0 (rotation day 8) - all training units deploy from the cantonment area to the maneuver training area. This is a tactical deployment.

2. Training day 1 - TF B and TF C conduct collective tactical operations controlled by a single higher headquarters. TF A receives safety briefings in preparation for live fire exercises, conducts weapons calibration, conducts maintenance and logistics operations and completes the mission planning process.

3. Training day 2 - TF B and TF C conduct maintenance, logistics operations and execute planning/preparation for follow on missions. TF A conducts joint tactical live fire operations under control of a higher headquarters.

4. Training day 3 - TF B and TF C conduct collective tactical operations under a single higher headquarters. TF A conducts logistics, maintenance and mission planning/preparation operations.

5. Training day 4 - TF B and TF C conduct logistics, maintenance and mission planning/preparation

operations. TF A conducts joint tactical live fire operations.

6. Training day 5 - TF B and TF C conduct collective tactical operations under the control of a single higher headquarters. TF A conducts maintenance, logistics and mission planning/preparation operations.

7. Training day 6 - TF A, TF B and TF C conduct logistics, maintenance and mission planning/preparation operations.

8. Training day 7 - TF A conducts tactical operations controlled by a single higher headquarters. TF B and TF C conduct safety briefings, weapons calibration, maintenance, logistics and mission planning/preparation operations in preparation for live fire tactical operations.

9. Training day 8 - TF A conducts logistics, maintenance and mission planning/preparation operations. TF B and TF C conduct collective tactical live fire operations under the control of a single higher headquarters.

10. Training day 9 - TF A conducts tactical operations under the control of a single higher headquarters. TF B and TF C conduct logistics, maintenance and mission planning/preparation operations.

11. Training day 10 - TF A conducts maintenance, logistics and mission planning/preparation operations. TF B and TF C conduct tactical live fire operations.

12. Training day 11 - TF A conducts tactical operations under the control of a single higher headquarters. TF B and TF C conduct logistics, maintenance and mission planning/preparation operations.

13. Training day 12 - TF A, TF B and TF C conduct logistics, maintenance and mission planning/preparation operations.

14. Training day 13 & 14 - TF A, TF B and TF C conduct collective tactical operations under the control of a single higher headquarters. At the conclusion of operations on training day 14, the rotational units conduct a tactical redeployment to the cantonment area.

All non-live fire tactical missions are force-on-force operations against a live opposing force using MILES equipment to assess casualties and equipment losses. All tactical missions are combined arms operations integrating combat support and combat service support assets as dictated by the tactical situation. Additionally, all operations are joint operations.

c. Reconciliation of Differences - Sufficient unit-level training days exist for the NTC to execute its mission. No reconciliation required.

2. (Live Fire) Ranges - See 1 above.

3.02 Projected Future Requirements:

a. Unit Changes - With increased lethality and capability of weapons systems and equipment due to state of the art technology, the NTC, where one can integrate all the combat multipliers, has become the premier location for training at the task force level. Currently, a maneuver brigade with three maneuver task forces and supporting combat support (DS artillery battalion, attack aviation battalion) and combat service support (Forward Support Battalion, division support area minus) elements is the largest organization that trains at the NTC. In FY 94 divisional cavalry squadrons will begin training at the NTC with a two task force brigade. Also in FY 94, an aviation brigade with its organic assets will participate in several rotations with a two task force maneuver brigade. FY 95 will see the first of what will become one reserve component rotation annually.

b. Impacts on Unit-Level Baseline Requirements - Addition of divisional cavalry squadrons aviation brigades and the reserve component to units training at the NTC has no impact on unit-level training day requirements provided the current 28 day rotation cycle remains unchanged. A major impact occurs in unit-level training acreage requirements. The nature of the operations conducted and the doctrinal distances these type units cover exacerbates the already limited maneuver training area shortfalls. Armored cavalry squadrons work over extended distances. Coupled with a standard armored or mechanized task force, the maneuver training acreage requirement increases from 120,585 acres (mechanized task force movement to contact) to 506,555 (mechanized task force movement to contact preceded by a zone recon) for a movement to contact mission. Similar increases occur with the participation of an aviation brigade in standard missions. It is uncertain what impact reserve component rotations will have on maneuver training area requirements. The exact configuration of reserve component rotations at the NTC is not yet known. It is anticipated these rotations will consist of three maneuver task forces conducting seven days of lane training followed by four days of force-on-force maneuver training. Reserve component rotations should have the same maneuver training requirements as a normal rotation.

3.04 Other Considerations - Several additional factors require consideration.

a. The Leach Lake Gunnery Range occupies most of northern Fort Irwin. This 92,625 acre area is an impact area for

Army, Air Force and Navy live fire operations. At first glance, this area seems ideally suited for establishing an additional maneuver corridor. However, since World War II all of the armed services have used Leach Lake Gunnery Range as an impact area. Unexploded munitions, ranging from 40mm grenades to 2000 pound bombs, litter the impact area. Aerial delivered cluster munitions contaminate several areas. Fort Irwin has recently negotiated an interservice support agreement with the Air Force to begin clearing operations of Leach Lake Gunnery Range. This will be an expensive and time consuming process, covering a five to ten year period. This area will not be available for maneuver in the foreseeable future.

The desert tortoise off limits area, an approximately 20,000 acre tortoise study habitat on Fort Irwin, runs the entire length of the installation's southern boundary. The actual off limits area, with its associated buffer zone, significantly reduces training unit maneuver options during tactical operations utilizing the NTC's southern corridor. The restrictive maneuver capacity of the southern corridor also severely limits rotation scenario design. As a result, this corridor is seldom used.

A third consideration is Goldstone, The National Aeronautics and Space Administrations Deep Space Communications complex. It occupies 33,241 acres of Fort Irwin's western boundary. Limited access through this area exists during deep space monitoring missions. This significantly limits logistical and maneuver element traffic into the central maneuver corridor. On occasion, it is necessary for units artificially to enter the center of the maneuver training corridor destroying the tactical scenario for ongoing operations. As a result of the Goldstone Deep Space Communications Complex mission, limited access exists to the movement corridor/maneuver training acreage it encompasses.

3.05 Summary - Current maneuver training acreage at the NTC is insufficient to meet the needs of rotational training units. With a gross proven single mission acreage requirement of 611,575 acres anticipated to rise to 773,176 acres with the addition of divisional armored cavalry squadrons to normal rotations, the need for additional maneuver training acreage is immediate. The arrival of modern equipment with state-of-the-art technology, that allows units to expand their areas of influence and sphere of command and control, further compounds the need for additional maneuver training acreage. The acquisition of additional maneuver training acreage is no longer a desire, it is an absolute necessity.

Section IV - Army Training Land Analysis Model (ATLAM)

4.01 Methodology - The ATLAM methodology uses an acre-day approach for calculating maneuver area requirements. It uses tabular data found in Appendix A of TC 25-1 that displays area requirements for mission training plan (MTP) tasks performed. The MTP area requirements combine both maximum effective weapon ranges and maneuver frontage and depth requirements. The focus of this study is at the battalion task force level.

Area requirements for MTP tasks performed are expressed in kilometers squared (Km^2). Multiply these area requirements by unit densities (the number of units to execute a given task), the number of iterations of training (how often the task will be performed during the rotation) and the number of days per iteration (number of days a single task will last). This yields the gross kilometer squared (Km^2) days required to accomplish each MTP task by all units required to perform it. Convert Km^2 days to acre days using the factor of 247.1 acres per Km^2. Find the total acreage required for a single MTP task by dividing the total acre days for a given task by the number of days it is trained. As an example, an armored task force and a light infantry task force conduct a movement to contact (MTC) against an opposing force motorized rifle battalion forward detachment (MRB FD). The light infantry task force MTC requires 266 Km^2. The area required for the armored task force is not counted because both task forces will maneuver over the same ground for this operation. The MRB FD requires 240 Km^2. Add these numbers, since the battlefield physically duplicates both units, for a total requirement of 506 Km^2. They will conduct this mission once. Generally, each iteration of a task at the NTC equates to one day. Two BLUEFOR units execute this mission. Multiplying two units times 506 Km^2 yields 1012 Km^2 days. Multiply this number by 247.1 acres Km^2 to yield 250,065 acre days. Since this is a one day mission divide 250,065 acre days by one day resulting in a maneuver area requirement of 250,065 acres.

506 Km^2
$\underline{x\ 1}$ Iteration
506 Km^2 days
$\underline{x\ 2}$ density of units
1012 Km^2 days
$\underline{2471}$ acres/Km^2
250,065 acre days

$$\frac{250{,}065 \text{ acre days}}{1 \text{ day}} = 250{,}065 \text{ acres}$$

Determine the average maneuver area requirements for a given rotation by adding the acre day totals for all missions conducted during the rotation and dividing the total by 14 days, the length of the actual maneuver training portion of the rotation.

After calculating the total acres needed for maneuver training areas, the next step in the ATLAM process is to find the number of maneuver acres available on the installation. Compare the largest maneuver event acreage requirement with the available maneuver acreage. Then, make a determination whether the configuration of the available maneuver training area is adequate to conduct the largest training event required. If the configuration of maneuver training areas can accommodate the desired training and no shortfall exists between the amount of maneuver acreage required and the amount of maneuver acreage available, the process ends. However, if a deficit exists between the amount of maneuver acreage required and the amount of maneuver acreage available, the next step in the process is to identify alternative actions that may be taken locally to reduce or eliminate the deficiency. Compare the revised total acreage available to the total acreage requirement and determine the training land shortfall, if any. The next step is to evaluate the effect of the training land shortfall on unit readiness. Following this evaluation, identification of alternative actions that may be initiated by the MACOM or DA to mitigate or resolve the training land shortfall occurs. The final step in the process is to incorporate results of the ATLAM into the LURS.

4.02 Limitations of Approach - There are no limitations in using the ATLAM approach to determine maneuver training area acreage requirements or maneuver training area acreage shortfalls at the National Training Center.

4.03 Requirements - Maneuver land requirements necessary for the conduct of rotational training at the NTC follows (see Appendix D):

a. The single mission, conducted at the NTC, evaluated during this study requiring the greatest amount of maneuver acreage is the armored cavalry squadron advance guard mission opposed by a motorized rifle regiment forward detachment. The maneuver training land requirement is 611,573 acres.

b. The single rotation evaluated during this study requiring the greatest amount of maneuver acreage is the armored cavalry regiment rotation. The total maneuver training land requirement for this rotation is 732,513 acres.

c. Looking forward to FY 94 and participation of division cavalry squadrons in rotations, the single mission maneuver training land requirement increases to 741,300 acres. The single rotation maneuver training land requirement remains the same, 732,513 acres.

4.04 Current Capacity

a. The Fort Irwin reservation encompasses a total of 642,731 acres. A break down of land utilization follows:

1. Total current acreage	642,731
a. Leach Lake Tactics Range	92,625
b. Goldstone Deep Space Site	33,241
c. Cantonment Area	15,314
d. Non-Trafficable Terrain	139,631
e. Environmental Off Limits	21,500
f. Archeological Off Limits	3,250
g. Recreational Area	7,166
2. Total non-maneuver acres	312,727
3. Total available maneuver acres	330,004

b. Distribution of the available maneuver acres is generally among three east-west maneuver corridors. The northern corridor has approximately 50,000 maneuver acres. The central corridor has approximately 150,000 maneuver acres. The southern corridor has approximately 75,000 acres. Several additional smaller maneuver areas (Valley of Death, Red Lake, Hidden Valley, Arrowhead, Area B and Area C) covering the remaining 55,004 maneuver acres exist, the largest containing 9,000 maneuver acres.

4.05 Shortfall - The largest maneuver event acreage requirement is the basis for training land shortfalls identified by the ATLAM process. On this basis the armored task force deliberate attack with an armored cavalry squadron screen against a motorized rifle battalion defense with a security zone requires 741,300 acres. The installations existing available maneuver acreage, not considering its configuration, is 330,004 acres. This leaves a maneuver area acreage shortfall of 411,296 acres.

Considering the configuration of maneuver terrain at Fort Irwin, the largest single block of maneuver training land has approximately 150,000 acres. This results in a revised maneuver area acreage shortfall of 591,300 acres.

4.06 Summary - The ATLAM methodology is a viable means to determine maneuver training land requirements at the National Training Center. Using this process, the single largest maneuver event acreage requirement is 741,300 acres. When compared with the gross available maneuver training area acreage of 330,004 acres, a significant shortfall of 411,296 acres exists. When considering the configuration of maneuver training acreage at the NTC, the available maneuver acreage decreases to 150,000 acres with a resultant shortfall of 591,300 acres. Clearly, additional maneuver training land is necessary to maintain the training fidelity of tactical operations at the National Training Center.

Section V - Internal Management Actions Taken to Meet Shortfall

Review of internal management actions available to the installation to meet maneuver training land shortfalls resulted in their implementation. They include reclamation of impact areas, rotational scenario development and positioning of logistics elements/staging areas.

Since 1984, Fort Irwin has reclaimed more than 38,000 acres of former munitions impact areas to create additional maneuver training land. As mentioned earlier in Section III, paragraph 3.02 a.1.c, the NTC continues in these efforts, focused primarily on the Leach Lake Gunnery Range.

During scenario development, scenario writers evaluate every conceivable manner in which to use available maneuver land while striving to maintain scenario fidelity and realism. North-south tactical operations along the eastern post boundary, north-south operations in the center of the maneuver training area and operations beginning at the cantonment area moving south into the southern corridor have all been tried, unsuccessfully, to alleviate maneuver land shortfalls during tactical missions.

Positioning of logistics/staging sites immediately behind tactical units at the beginning of offensive missions occurs frequently. Although not doctrinally correct initially, as tactical units move forward during the conduct of their mission a semblance of the doctrinal tactical/logistical separation develops. Positioning of logistics/staging areas outside the tactical maneuver corridor in use and next to opposing force sectors also occurs frequently. Again, this helps create the doctrinal separation between tactical/logistical entities. Unfortunately, positioning units next to the opposing force often exposes them to enemy administrative logistics traffic and requires opening and closing of supply routes shared by several forces endangering the tactical sense of the scenario. Additionally, it is difficult at best for these units to maintain a proper intelligence perspective of the battlefield. Most importantly, internal management actions cannot alleviate the existing maneuver training area shortfall.

Section VI - Analysis of Other Internal Management Actions

6.01 Considered within the capability of the Installation Commander to implement, but rejected.

All internal management actions considered, within the capability of the Installation Commander, were implemented.

6.02 Considered but not within the capability of the Installation Commander to implement.

a. Reduction in the size/composition of units training at the National Training Center will eliminate the need for additional maneuver training land. At first, only one task force trained at Fort Irwin at any given time. With a corresponding reduction in required opposing force participation, Fort Irwin has sufficient maneuver training area acreage to accommodate a single task force in training. This would require a change to the current National Training Center mission. It also has serious implications on Army readiness in respect to the way we envision fighting today and in the future.

b. Fort Irwin shares its western boundary with a China Lake Naval Weapons Center testing and training area. The National Training Center has had several discussions with China Lake in an attempt to obtain a maneuver land use agreement to use a 160,000 acre tract of training land. Such a land use agreement would alleviate a portion of the existing maneuver training land shortfall. The Commanding General, Fort Irwin, met with the Commander of China Lake Naval Weapons Center to discuss the feasibility of the land use agreement. As a product of this meeting, the Navy commissioned a compatibility of use study. Results of the Navy study stated that existing China Lake missions/operations were not compatible with use of China Lake maneuver land by Army rotational training units. Accordingly, the Commander of China Lake Naval Weapons Center rejected the NTC request to enter into a land use agreement.

c. The acquisition of additional maneuver training land is the only alternative to alleviating the existing shortfall.

Section VII - Conclusions and Recommendations.

7.01 Conclusions

a. Following the Army Training Land Analysis Model as outlined in Chapter 3, TC 25-1 dated 30 September 1991, the National Training Center has a maneuver training area shortfall of 591,300 acres.

b. Fort Irwin implemented all available internal management actions to meet the existing maneuver training area shortfall.

c. Inclusion of additional combat/combat support units to the existing National Training Center troop list and evolving Army doctrine coupled with the technological modernization of equipment will exacerbate the existing maneuver area shortfall.

7.02 Recommendations - Recommend the acquisition of additional maneuver training area acreage, contiguous with existing maneuver areas, to alleviate the existing maneuver training land shortfall. No additional combat/combat support assets should be added to the existing rotational troop list until additional maneuver training land is available.

Appendix A - Fort Irwin Facilities

1. History - Captain John C. Fremont was the first member of the Army to visit Bitter Springs, an area located on Fort Irwin. Accompanied by Kit Carson, he passed through the present reservation in 1844. In 1846, the Army stationed the Mormon Battalion in the area, with headquarters in the Cajon Pass area. In 1860, the Army returned to the Fort Irwin area. During the Indian Wars, a unit patrolled the area and established a base camp on a hill overlooking Bitter Springs. There, they constructed a small stone fort. In the 1930s General George Patton used the area as a maneuver site for armored vehicles. Tank tracks from those maneuvers are still visible in places.

In 1940, President Roosvelt established a military reservation of 1,000 square miles in the area of the present day Fort Irwin. The reservation was named the Mojave Anti-Aircraft Range. On 4 November 1942, the post was officially designated Camp Irwin in honor of Major General George Leroy Irwin, the World War I battle commander of the 57th Field Artillery Brigade. The camp was deactivated in 1944 and reactivated in 1951 as a training center for combat units during the Korean War.

The post was designated a permanent Class I installation in August 1961 and was renamed Fort Irwin. During the Vietnam buildup, many types of units, primarily artillery and engineer, trained and deployed to Southeast Asia directly from the post.

In January 1971, the post was again deactivated and placed in maintenance status under the control of Fort MacArthur, California. In 1972, the California National Guard assumed full responsibility for the post. Despite deactivation the post served as a training site for the National Guard and Army Reserve.

Today the post is in a new era. The National Training Center officially activated on 16 October 1980, following years of planning and study at Department of the Army, Headquarters, Forces Command and the Army Training and Doctrine Command. Official activation of Fort Irwin as an active Army installation occurred on 1 July 1981.

2. Description - Located in the high Mojave Desert region of southern California, Fort Irwin is 37 miles north of the City of Barstow, the nearest civilian community. The current post population is:

Active Duty On Post	4,741
Active Duty Off Post	569
Military Family Members On Post	3,224
Military Family Members Off Post (Barstow)	3,033

Military Family Members Off Post (MCLB)	191
Contracted Civilians	1,688
APF Civilians	626
NAF Civilians	213
AAFES Employees	288
Corps of Engineer Civilians	4
Teachers at Fort Irwin School	65
MATES (Mobilization Training Equipment Site)	82
Total Post Population	14,724

Fort Irwin units include Headquarters National Training Center, Operations Group and the 177th Separate Armor Brigade. Weed Army Community Hospital provides medical treatment. Personnel support services include a Main Post Exchange, Commissary, Shoppette, fast food facilities, laundry and dry cleaning, two gas stations, on post banking and recreation facilities. Additionally, there are several craft shops and an Officer, NCO and Junior Enlisted clubs.

The Fort Irwin installation is located in the Mojave Desert of Southern California which is part of the larger Basin and Range physiographic province. Landforms on the reservation consist of low and high planins covering 66% of the area, low and high hills covering 32% of the area and mountains covering the remainder. The hills and mountain ranges trend roughly northwest - southeast and are rough, barren, dissected and steep. Elevations range from 6,100 feet in the Avawatz Mountains to 1,300 feet near Bitter Springs. Fort Irwin is fully trafficable by foot troops, 50% trafficable by wheeled vehicles and 60% trafficable by tracked vehicles. The climate is dry, with four to six inches of rainfall annually. This precipitation frequently occurs in short duration, heavy downpours which quickly inundates dry lake beds and washes out roads. Temperatures range from the mid thirties during the winter months and can reach 110+ during summer months.

3. Billets.

(a) Billeting facilities consist of:

BOQ	118	(100 are adequate)
BEQ	66	(30 are adequate)
Barracks Spaces	2,314	(1,828 are adequate)*
Transient Quarters	42	

(b) Family Housing facilities consist of:

Quarters	1,636**
Trailer Spaces	75
Leased Quarters	0

* 148 additional barracks spaces are scheduled for completion by March 1996.

** 172 additional units will be completed by February 1994 and 220 additional units are scheduled for completion by May 1995.

4. Aviation Facilities.

a. Fort Irwin Airfields.

1. Bicycle Lake Army Airfield (enclosure 1), located 1/4 mile southeast of main post has two dirt runways. One is 9,500 feet long the second is 5,800 feet long. It can accomodate C-130 aircraft landings. Located directly to the south of the runways is an aircraft parking ramp (12,900 square yards) with five pads and two refueling pads. Thirty-nine PSP pads located to the west of Bicycle Lake Operations provides additional aircraft parking. Sufficient space exists to park 44 rotary wing aircraft. A maintenance hangar constructed of wood and sheet metal exists with a working space of approximately 8,100 square feet. It is currently used to store multiple integrated laser engagement system equipment. The Bicycle Lake Operations building contains 3,450 square feet of office space. This space accomodates Range Control, Airfield Operations and flight planning. Adjacent to the Airfield Operations building is a modular building consisting of 3,600 square feet. This building houses the installation G3/DPTMSEC Aviation office and the Air Force Weather Detachment. Located between the Airfield Operations building and the maintenance hanger is a nonoperational control tower. Bicycle Lake is operational 24 hours a day, seven days a week. It operates on assigned UHF, VHF and FM frequencies. The airfield is not equipped for instrument approach procedures. Bicycle Lake's current fuel storage capacity is 25,000 gallons of JP8. The Bicycle Lake runways are under approximately four to six inches of water during the winter season.

2. The main Post Helipad, located on the cantonment, consists of three concrete helipads utilized for VIP arrival and departure and medical evacuation aircraft. Additional parking for three aircraft is available on the south side of the helipad. Covered by asphalt, the main post helipad encompasses approximately three acres.

The main cantonment area, housing and the hospital surround the helipad on three sides. This allows only one direction for arrivals and departures.

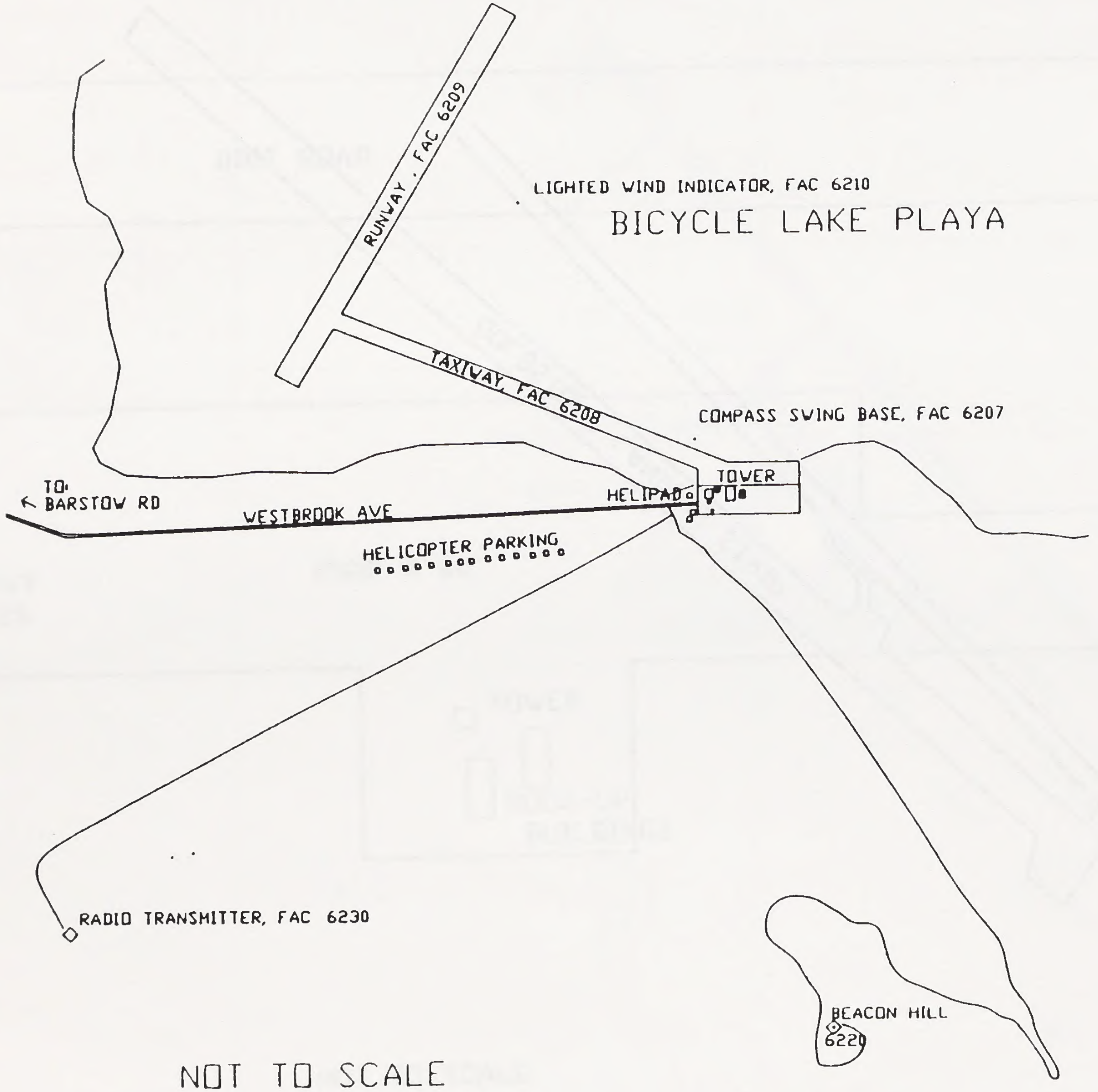
3. Goldstone Lake Airstrip (enclosure 2), located approximately 10 miles northwest of the Fort Irwin cantonment area, is a visual flight rule, 6,000 foot hard surface runway. Sharply rising terrain surrounds the air strip on three sides. Additionally, this area is a military operational area for low level jet aircraft training. Numerous large dish shaped antennas which give off high levels of radio frequency emissions dot the Goldstone complex. A one nautical mile avoidance is necessary for these antennae. Prior permission is necessary before using this airstrip.

4. Nelson Landing Zone (enclosure 3), located in the western portion of the central maneuver corridor, is a 4,500 foot dirt landing strip. It can support C-130 aircraft landings. No more than three aircraft may operate on the ground at any given time. Used primarily for contingency operation rotation execution, this landing strip requires repair and certification prior to each use.

5. Red Pass Landing Zone (enclosure 4), located in the southeastern portion of the military reservation, is a 5,200 foot dirt landing strip. It can support C-130 aircraft landings. No more than three aircraft may operate on the ground at any given time. Used primarily for contingency operation rotation execution, this landing strip requires repair and certification prior to each use.

6. Barstow-Daggett Airport (enclosure 5) is a civilian airport located approximately 30 miles south of Fort Irwin. This airport has two runways. One is 5,150 feet long the second is 6,400 feet long. Both runways are hard surface. Facilities include an aircraft parking ramp (300 x 3,000 feet) and two hangers totaling 45,280 square feet. An office building totaling 2,928 square feet houses aviation operations, flight dispatch/planning, standards and safety. Barstow-Daggetts current fuel storage capabilities are 18,000 gallons of Jet-A and 16,000 gallons of AVGAS. A VOR navigational facility gives the airfield an all weather capability.

6 Enclosures
1. Bike Lake Landing Zone
2. Goldstone Landing Zone
3. Nelson Landing Zone
4. Red Pass Landing zone
5. Airport Diagram
6. NTC Cantonment



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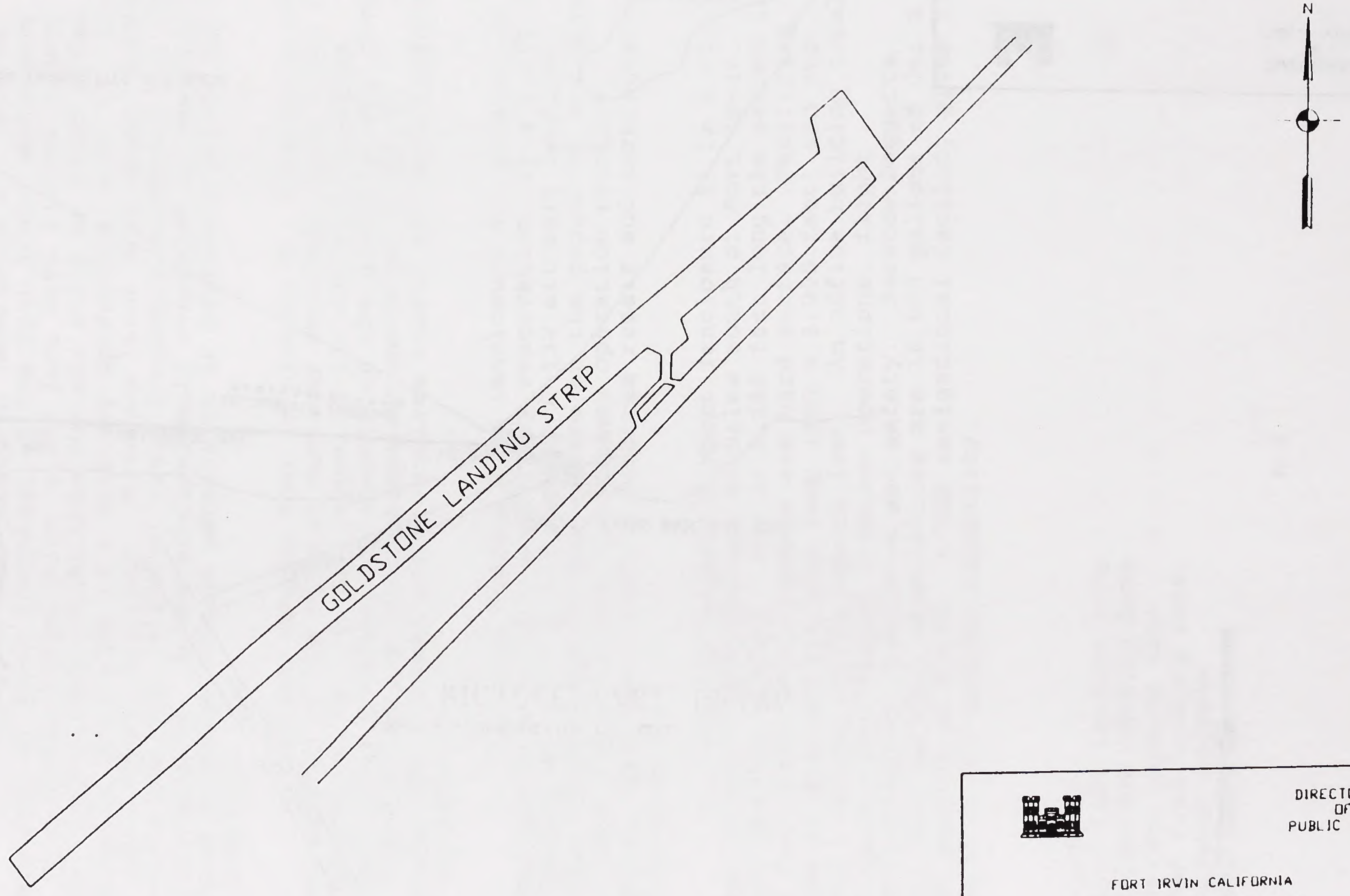
FORT IRWIN CALIFORNIA
NATIONAL TRAINING CENTER

BIKE LAKE LANDING ZONE

Enclosure 1



NOT TO SCALE

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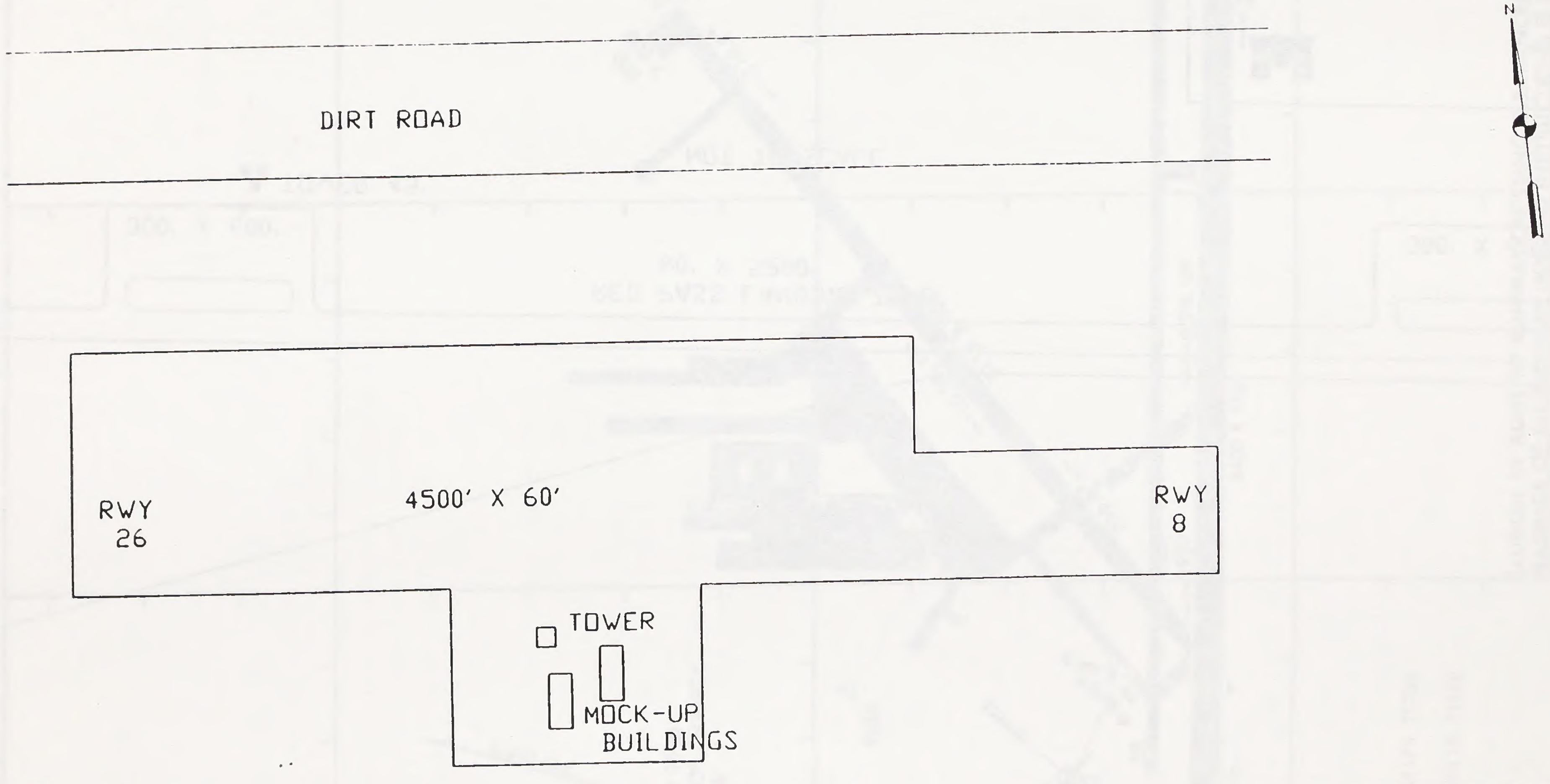
NATIONAL TRAINING CENTER

GOLDSTONE LANDING ZONE

Enclosure 2

Enclosure 3



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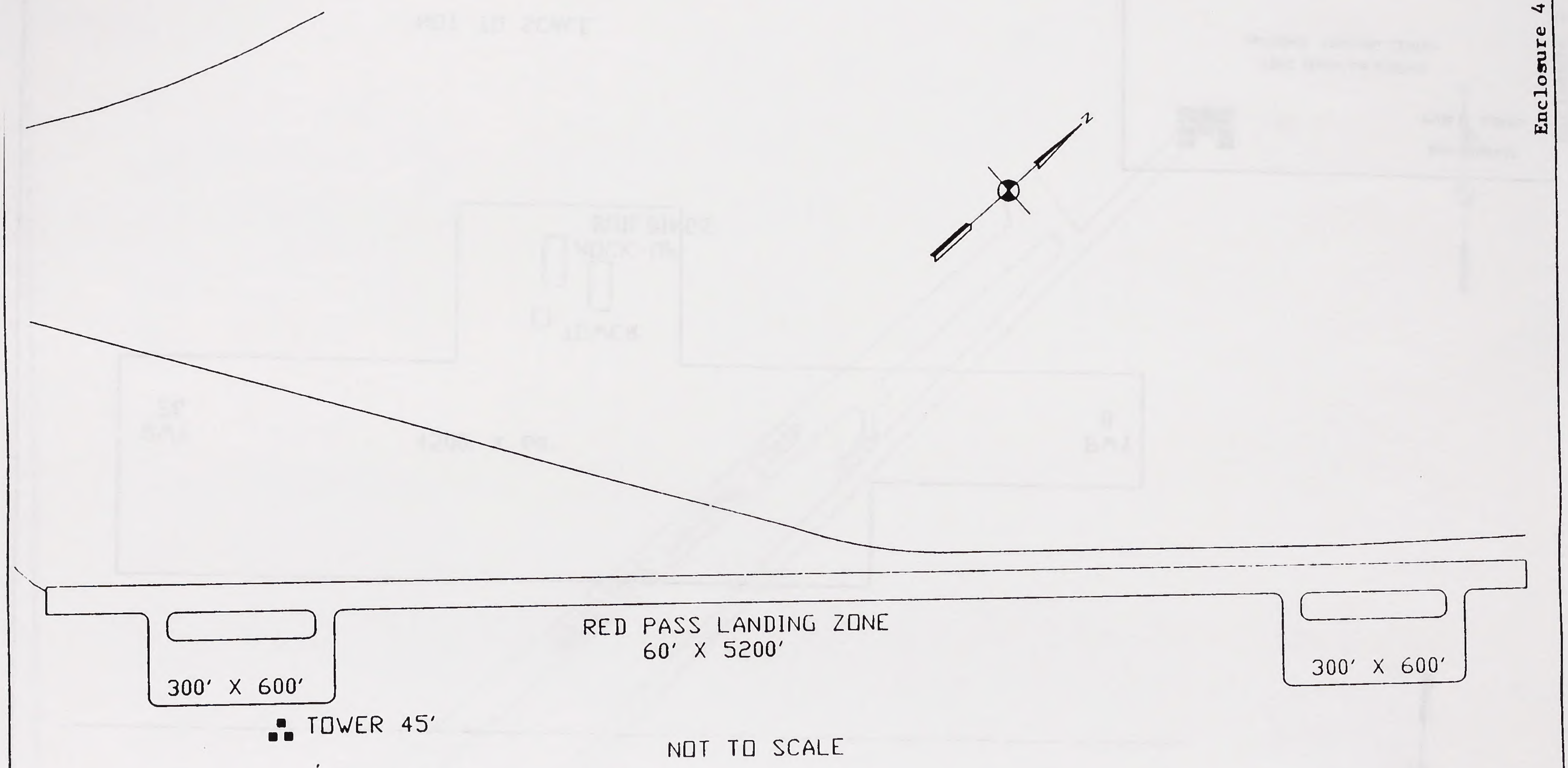
NATIONAL TRAINING CENTER

NELSON LANDING ZONE

Enclosure 4



NOTE: DIRT BERM SURROUNDS LANDING ZONE TO REDUCE ENTRY OF UNAUTHORIZED VEHICLES, ENTRY POINTS ARE LOCATED ON THE SOUTHWEST SIDE.

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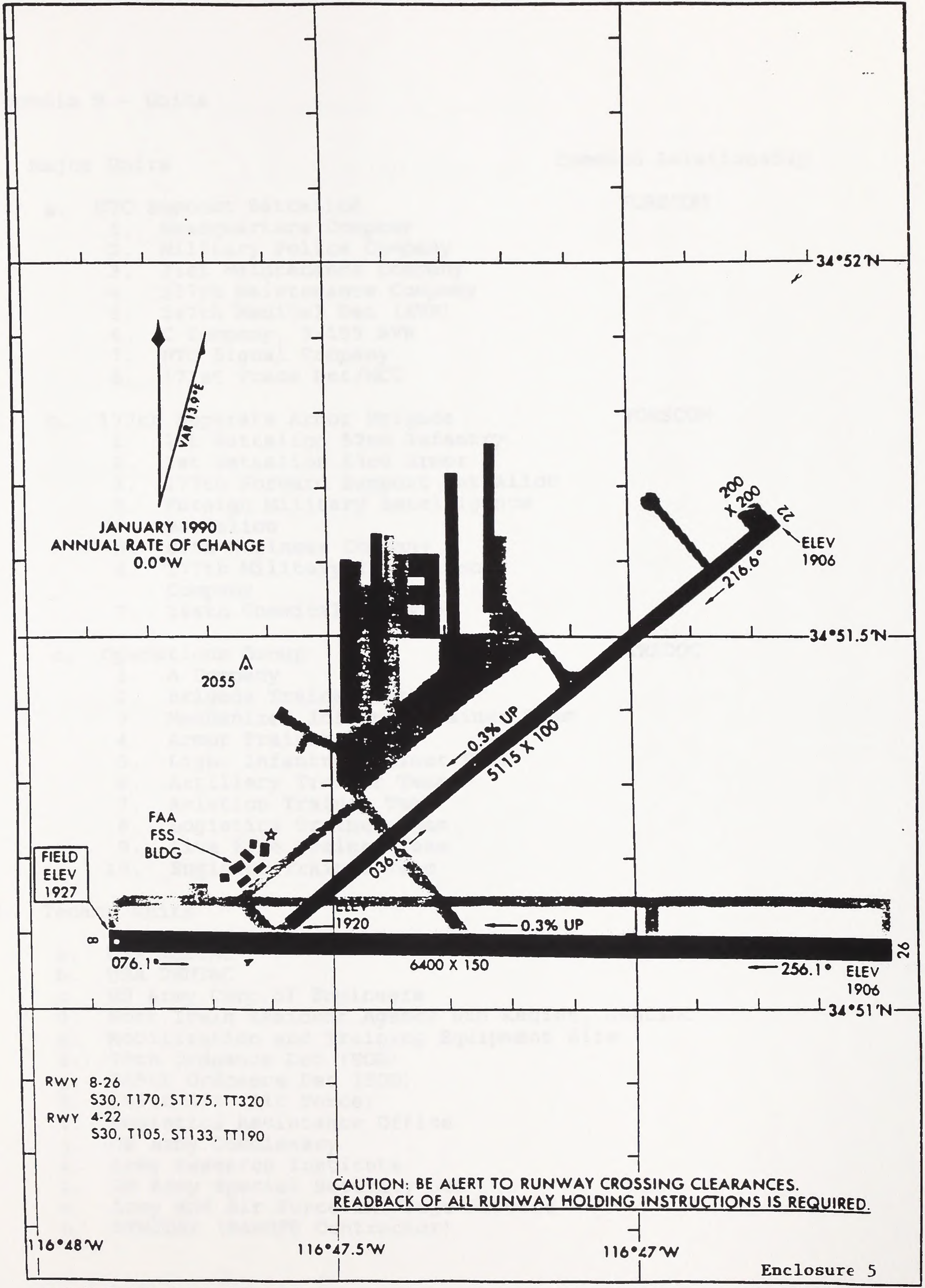
RED PASS LANDING ZONE

AIRPORT DIAGRAM

AL-104 (FAA)

DAGGETT/BARSTOW-DAGGETT (DAG)
DAGGETT, CALIFORNIA



CAUTION: BE ALERT TO RUNWAY CROSSING CLEARANCES.
READBACK OF ALL RUNWAY HOLDING INSTRUCTIONS IS REQUIRED.

Enclosure 5

Appendix B - Units

1. Major Units — Command Relationship

Major Units	Command Relationship
a. NTC Support Battalion 1. Headquarters Company 2. Military Police Company 3. 31st Maintenance Company 4. 557th Maintenance Company 5. 247th Medical Det (AVN) 6. C Company, 3-159 AVN 7. NTC Signal Company 8. 171st Trans Det/MCC	FORSCOM
b. 177th Separate Armor Brigade 1. 1st Battalion 52nd Infantry 2. 1st Battalion 63rd Armor 3. 177th Forward Support Battalion 4. Foreign Military Intelligence Battalion 5. 87th Engineer Company 6. 177th Military Intelligence Company 7. 164th Chemical Company	FORSCOM
c. Operations Group 1. A Company 2. Brigade Trainer Team 3. Mechanized Infantry Trainer Team 4. Armor Trainer Team 5. Light Infantry Trainer Team 6. Artillery Trainer Team 7. Aviation Trainer Team 8. Logistics Trainer Team 9. Live Fire Trainer Team 10. Engineer Trainer Team	TRADOC

2. Tenant Units

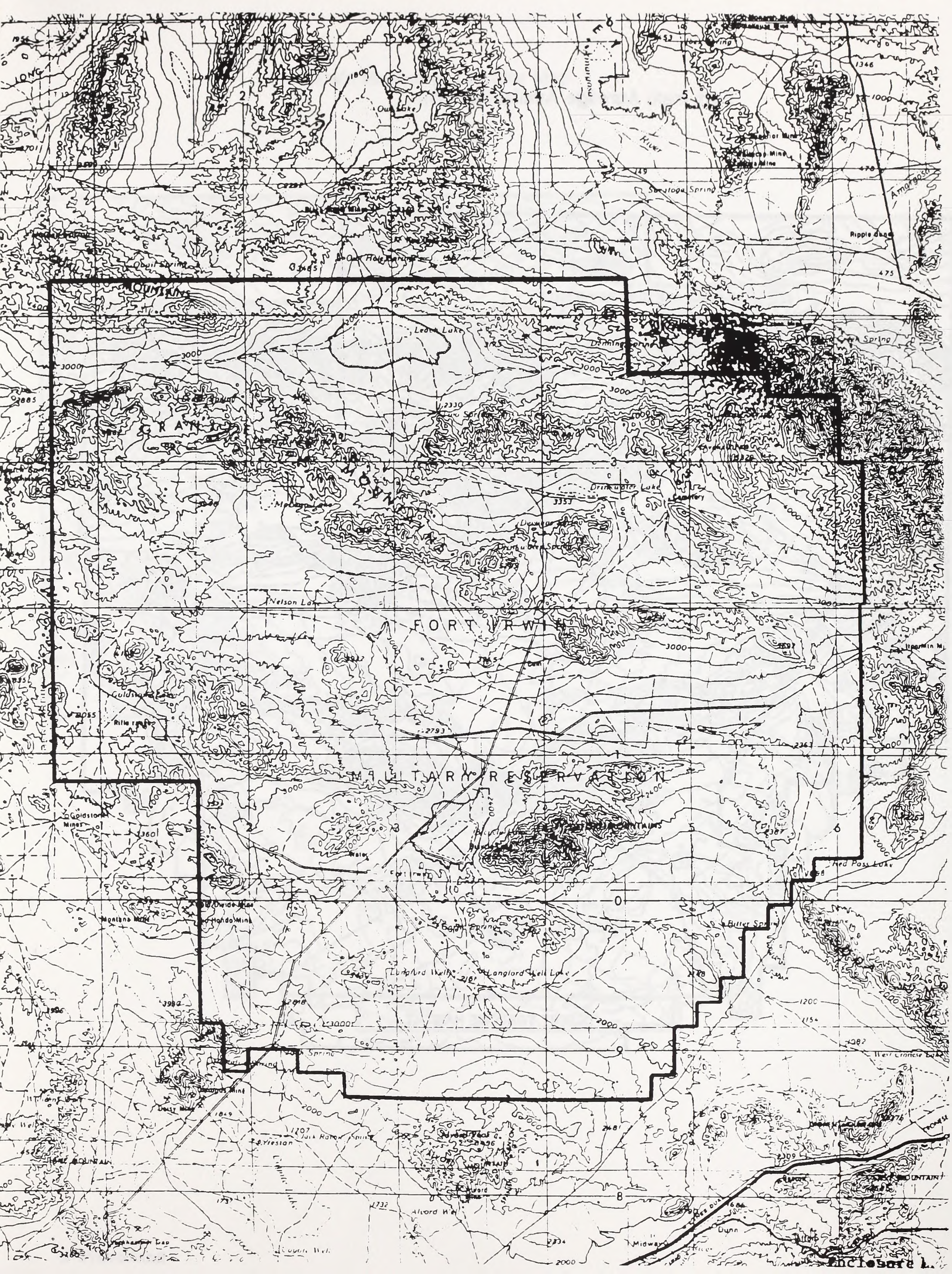
a. USA MEDDAC
b. USA DENTAC
c. US Army Corp of Engineers
d. Fort Irwin Resident Agency 6th Region, USACIDC
e. Mobilization and Training Equipment Site
f. 70th Ordnance Det (EOD)
g. 259th Ordnance Det (EOD)
h. 549th JTS (Air Force)
i. Logistics Assistance Office
j. US Army Commissary
k. Army Research Institute
l. US Army Special Security Det
m. Army and Air Force Exchange Service
n. DYNCORP (BASOPS Contractor)

Appendix C - Fort Irwin Acreage Availability

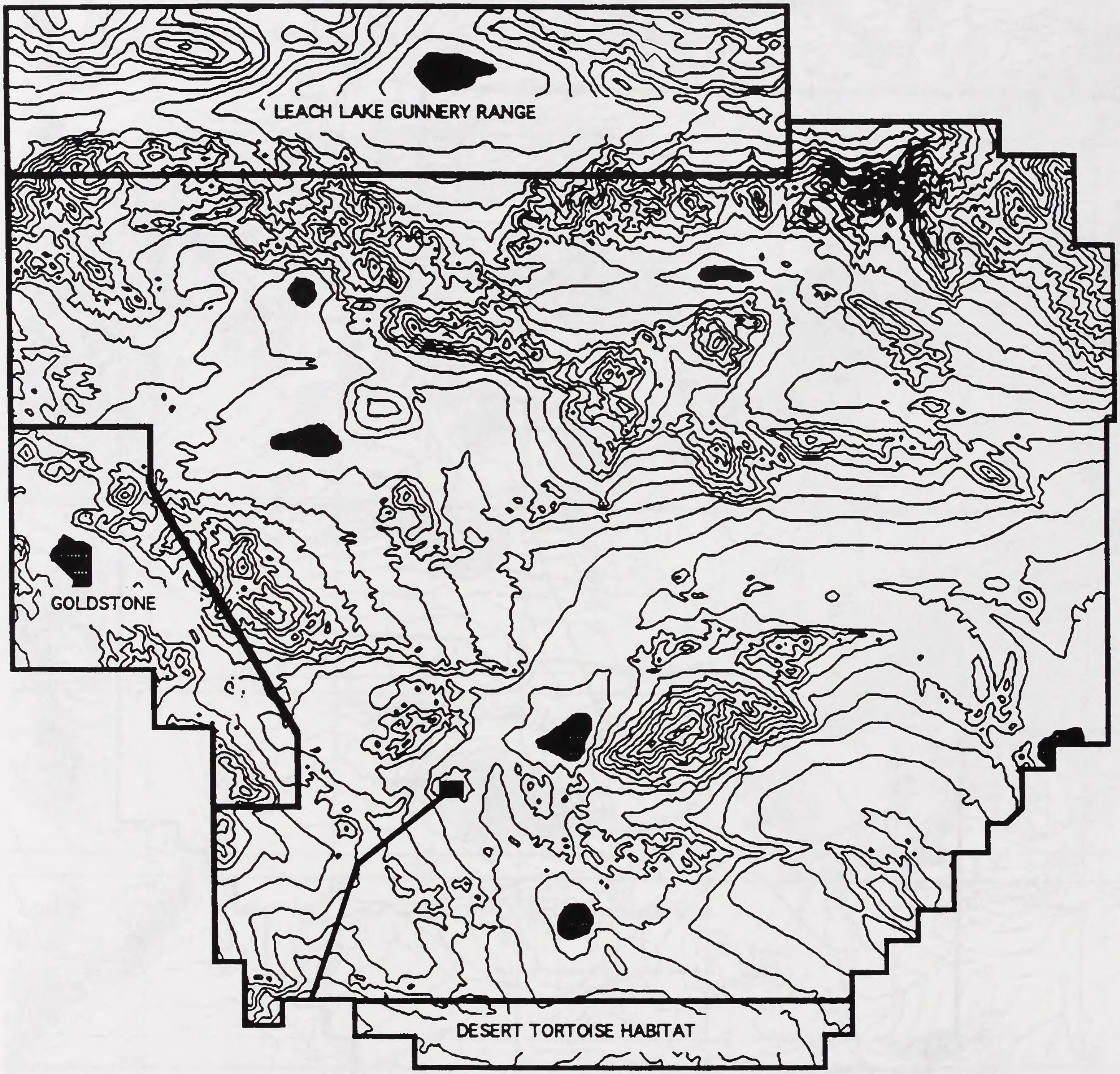
ACREAGE AVAILABILITY

NTC TOTAL ACREAGE	642,731
- LEACH LAKE IMPACT AREA	92,625
- GOLDSTONE	33,241
- CANTONMENT	15,314
- NON-TRAFFICABLE	139,631
- ENVIRONMENTAL OFF LIMITS	21,500
- ARCHAEOLOGICAL OFF LIMITS	3,250
- RECREATIONAL AREA	7,166
TOTAL NON-MANEUVER ACRES	312,727
TOTAL AVAILABLE MANEUVER ACRES	330,004

3 Enclosures
1. Fort Irwin Military Reservation Map
2. Fort Irwin Acreage Availability Map
3. Fort Irwin Maneuver Corridor Map

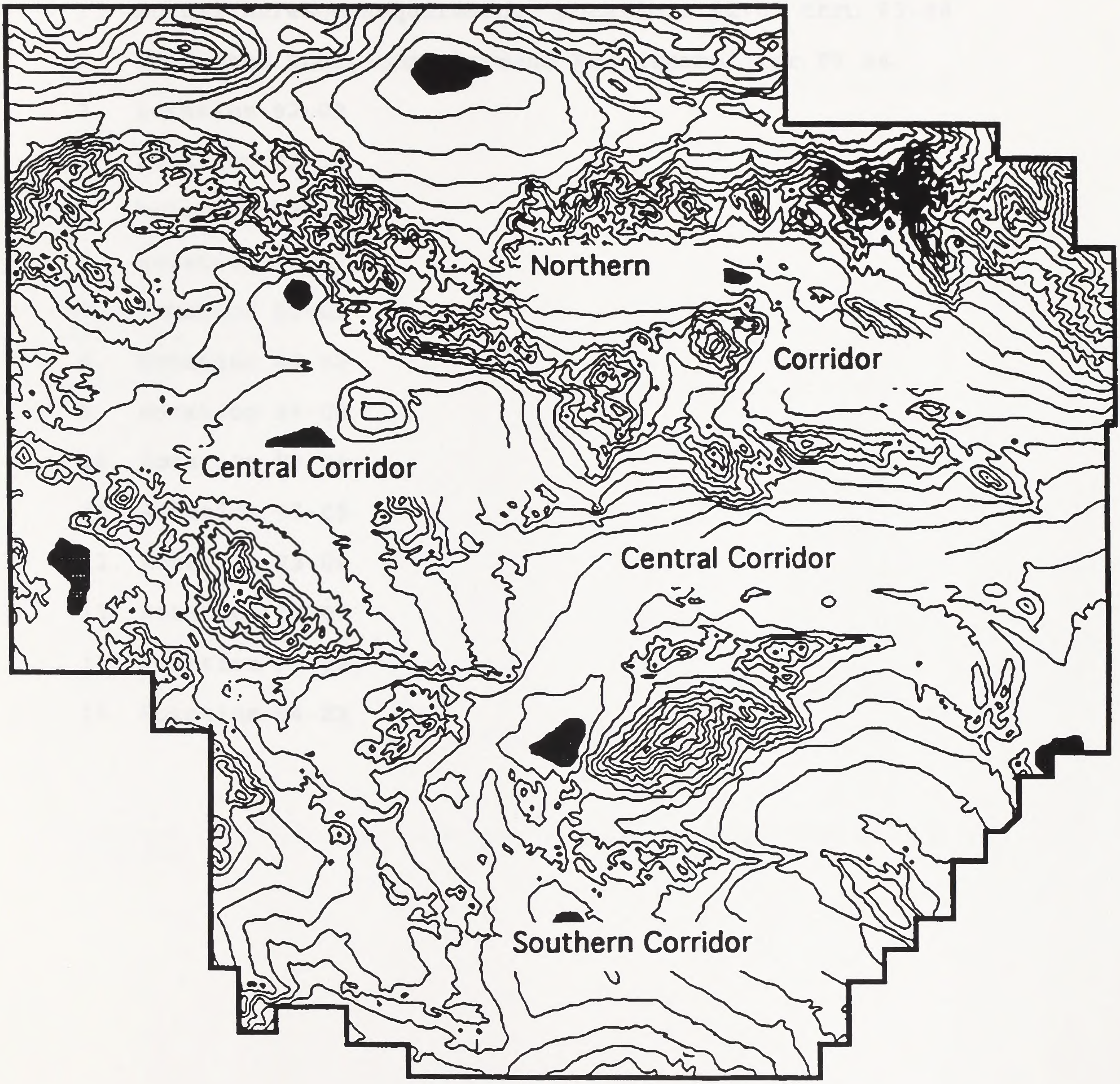

Owl Lake
River
Saratoga Spring
Amargosa
Ripple dunes
Leach Lake
Denning Spring
GRANITE
MOUNTAINS
Drinkwater Lake
Nelson Lake
FORT IRWIN
MILITARY RESERVATION
Goldstone Lake
Rifle range
Goldstone Mines
Montana Mine
Divide Mine
Hondo Mine
Fort Irwin
Red Pass Lake
Bitter Spring
Langford Well
Langford Well Lake
Alvord Well
Midway
Dunn
3000
2000
1000

Fort Irwin Acreage Availability Map



Enclosure 2

Fort Irwin Maneuver Corridor Map



Enclosure 3

Appendix D - Rotational Unit Maneuver Acreage Requirements

1. Actual Acreage Requirement, Rotations 92-09 thru 93-08
2. Predicted Rotational Acreage Requirement for FY 94
3. Rotation 92-09
4. Rotation 92-10
5. Rotation 92-11
6. Rotation 92-12
7. Rotation 93-01
8. Rotation 93-02
9. Rotation 93-03
10. Rotation 93-04
11. Rotation 93-05
12. Rotation 93-06
13. Rotation 93-07
14. Rotation 93-08
15. Rotation 94-XX

ACTUAL ACREAGE REQUIREMENT ROTATIONS 92-09 THRU 93-08

ROTATION		ACREAGE REQUIRED*
ROTATION 92-09		572,742
ROTATION 92-10		454,823
ROTATION 92-11		532,183
ROTATION 92-12		577,755
ROTATION 93-01		732,513
ROTATION 93-02		556,963
ROTATION 93-03		437,014
ROTATION 93-04		532,324
ROTATION 93-05		718,073
ROTATION 93-06		315,282
ROTATION 93-07		583,368
ROTATION 93-08		611,749
	AVG ACRES REQUIRED	552,066

*ACREAGE REQUIRED BASED ON ACTUAL MISSIONS PERFORMED DURING THE ROTATION.

Enclosure 1

PREDICTED ROTATIONAL ACREAGE REQUIREMENT FOR FY 94

ROTATION		ACREAGE REQUIRED
ROTATION 94-01		468,837
ROTATION 94-02		725,397
ROTATION 94-03		718,073
ROTATION 94-04		388,776
ROTATION 94-05		566,726
ROTATION 94-06		725,397
ROTATION 94-07		566,726
ROTATION 94-08		388,776
ROTATION 94-09		566,726
ROTATION 94-10		732,513
ROTATION 94-11		468,837
ROTATION 94-12		725,397
	AVG ACRES REQUIRED	586,848

Enclosure 2

ROTATION 92-09
ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB FD	266 + 240	506 km^2 x 1 iterations 506 x 2 density of units 1012 x247.1 acres/km^2 250,065 acre days
DATK/MRB DEF	208 + 175	383 km^2 x 2 iterations 766 x 2 density of units 1532 x247.1 acres/km^2 378,557 acre days
MTC/TK BN FD	248 + 240	488 km^2 x 3 iterations 1464 x 1 density of units 1464 x247.1 acres/km^2 361,754 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 3 iterations 1326 x 2 density of units 2652 x247.1 acres/km^2 655,309 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 3 iterations 1134 x 1 density of units 1134 x247.1 acres/km^2 280,211 acre days

Enclosure 3

DATK/MRR DEF 276 + 375

651 km^2
x 2 iterations
1302
x 3 density of units
3906
x247.1 acres/km^2
965,173 acre days

SPT PLT OPNS 20
(prep day opns)

20 km^2
x 6 iterations
120
x 3 density of units
360
x247.1 acres/km^2
88,956 acre days

MED PLT OPNS 8
(prep day opns)

8 km^2
x 6 iterations
48
x 3 density of units
144
x247.1 acres/km^2
35,582 acre days

FA BN (155 SP) 270

270 km^2
x 8 iterations
2160
x 1 density of units
2160
x247.1 acres/km^2
533,736 acre days

FA BTRY (105 Towed) 48

48 km^2
x 8 iterations
384
x 1 density of units
384
x247.1 acres/km^2
94,886 acre days

COLL/JAM PLT 11

11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4

4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17

17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10

10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB 120
120 km^2
x14 iterations
1680
x 1
1680
x247.1 acres/km^2
415,128 acre days

ATK HEL. CO.	600	600	km^2
		x 4	iterations
		2400	
		x 3	density of units
		7200	
		x247.1	acres/km^2
		1,779,120	acre days

cumulative acre days = 8,018,393

total training days = 14

total training acres required = $\frac{8,018,393}{14}$ = 572,742

ROTATION 92-10
ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB FD	266 + 240	506 km^2 x 1 iterations 506 x 2 density of units 1012 x247.1 acres/km^2 250,065 acre days
MTC/MRB FD	248 + 240	488 km^2 x 1 iterations 488 x 1 density of units 488 x247.1 acres/km^2 120,585 acre days
DATK/MRB DEF	208 + 175	383 km^2 x 3 iterations 1149 x 2 density of units 2298 x247.1 acres/km^2 567,836 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 3 iterations 1326 x 2 density of units 2652 x247.1 acres/km^2 655,309 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 3 iterations 1134 x 1 density of units 1134 x247.1 acres/km^2 280,211 acre days

Enclosure 4

DATK/MRR DEF 276 + 375
651 km^2
x 2 iterations
1302
x 3 density of units
3906
x247.1 acres/km^2
965,173 acre days

DATK/MRR DEF 68 + 175
243 km^2
x 3 iterations
729
x 1 density of units
729
x247.1 acres/km^2
180,136 acre days

SPT PLT OPNS
(prep day opns) 20
20 km^2
x 6 iterations
120
x 3 density of units
360
x247.1 acres/km^2
88,956 acre days

MED PLT OPNS
(prep day opns) 8
8 km^2
x 6 iterations
48
x 3 density of units
144
x247.1 acres/km^2
35,582 acre days

FA BN (155 SP) 270
270 km^2
x 8 iterations
2160
x 1 density of units
2160
x247.1 acres/km^2
533,736 acre days

FA BTRY (105 Towed) 48
48 km^2
x 8 iterations
384
x 1 density of units
384
x247.1 acres/km^2
94,886 acre days

COLL/JAM PLT 11

11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4

4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17

17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10

10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB	120	120 km^2 x14 iterations 1680 x 1 1680 x247.1 acres/km^2 415,128 acre days

cumulative acre days = 6,367,519

total training days = 14

total training acres required = $\frac{6,367,519}{14}$ = 454,823

ROTATION 92-11
ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB AG	266 + 240	506 km^2 x 1 iterations 506 x 2 density of units 1012 x247.1 acres/km^2 250,065 acre days
MTC/MRB AG	248 + 240	488 km^2 x 2 iterations 976 x 1 density of units 976 x247.1 acres/km^2 241,170 acre days
DATK/MRB DEF	208 + 175	383 km^2 x 3 iterations 1149 x 2 density of units 2298 x247.1 acres/km^2 567,836 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 2 iterations 884 x 2 density of units 1768 x247.1 acres/km^2 436,873 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 2 iterations 756 x 1 density of units 756 x247.1 acres/km^2 186,808 acre days

Enclosure 5

DATK/MRB DEF	68 + 175	243 km^2 x 2 iterations 486 x 1 density of units 486 x247.1 acres/km^2 120,091 acre days
DATK/MRR DEF	276 + 375	651 km^2 x 2 iterations 1302 x 3 density of units 3906 x247.1 acres/km^2 965,173 acre days
SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 3 density of units 360 x247.1 acres/km^2 88,956 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 3 density of units 144 x247.1 acres/km^2 35,582 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days
FA BTRY (105 Towed)	48	48 km^2 x 8 iterations 384 x 1 density of units 384 x247.1 acres/km^2 94,886 acre days

COLL/JAM PLT 11

11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4

4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17

17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10

10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

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100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

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377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB 120 120 km^2
x14 iterations
1680
x 1
1680
x247.1 acres/km^2
415,128 acre days

ATK HEL. CO.	600	600	km^2
		x 3	iterations
		1680	
		x 3	
		5400	
		x247.1	acres/km^2
		1,334,340	acre days

cumulative acre days = 7,450,560

total training days = 14

total training acres required = $\frac{7,450,560}{14}$ = 532,183

ROTATION 92-12
ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB FD	266 + 240	506 km^2 x 1 iterations 506 x 2 density of units 1012 x247.1 acres/km^2 250,065 acre days
MTC/MRB FD	589 + 240	829 km^2 x 1 iterations 829 x 3 density of units 2487 x247.1 acres/km^2 614,538 acre days
DATK/MRB DEF	208 + 175	383 km^2 x 4 iterations 1532 x 2 density of units 3064 x247.1 acres/km^2 757,114 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 3 iterations 1326 x 2 density of units 2652 x247.1 acres/km^2 655,309 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 3 iterations 1134 x 1 density of units 1134 x247.1 acres/km^2 280,211 acre days

Enclosure 6

DATK/MRR DEF	276 + 175	451 km^2 x 2 iterations 902 x 3 density of units 2706 x247.1 acres/km^2 668,653 acre days
DATK/MRB DEF	68 + 175	243 km^2 x 3 iterations 729 x 1 density of units 729 x247.1 acres/km^2 180,136 acre days
SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 3 density of units 360 x247.1 acres/km^2 88,956 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 3 density of units 144 x247.1 acres/km^2 35,582 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days
FA BTRY (105 Towed)	48	48 km^2 x 8 iterations 384 x 1 density of units 384 x247.1 acres/km^2 94,886 acre days

COLL/JAM PLT 11
11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4
4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17
17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10
10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

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100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

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377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB 120
120 km^2
x14 iterations
1680
x 1
1680
x247.1 acres/km^2
415,128 acre days

ATK HEL. CO. 600

600 km^2
x 3 iterations
1800
x 3
5400
x247.1 acres/km^2
1,334,340 acre days

cumulative acre days = 8,088,570

total training days = 14

total training acres required = $\frac{8,088,570}{14}$ = 577,755

ROTATION 93-01
ARMORED CAVALRY ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
AG/MRR FD	600 + 1875	2475 km^2 x 4 iterations 9900 x 1 density of units 9900 x247.1 acres/km^2 2,446,290 acre days
ZONE RECON/MRR DEF W/SZ	600 + 375	975 km^2 x 2 iterations 1950 x 1 density of units 1950 x247.1 acres/km^2 481,845 acre days
COVER/MRR ATK + FD	600 + 480	1080 km^2 x 4 iterations 4320 x 1 density of units 4320 x247.1 acres/km^2 1,067,472 acre days
ATK/MRR DEF W/SZ	75 + 225	300 km^2 x 2 iterations 600 x 1 density of units 600 x247.1 acres/km^2 148,260 acre days
DEF/MRR ATK W/FD	100 + 480	580 km^2 x 2 iterations 1160 x 1 density of units 1160 x247.1 acres/km^2 286,636 acre days

Enclosure 7

ADV COVER/MRR DEF W/SZ	600 + 375	975 km^2 x 3 iterations 2925 x 2 density of units 5850 x247.1 acres/km^2 1,445,535 acre days
SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 2 density of units 240 x247.1 acres/km^2 59,304 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 2 density of units 96 x247.1 acres/km^2 23,722 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days
FA BTRY (155 SP)	48	48 km^2 x 8 iterations 384 x 2 density of units 768 x247.1 acres/km^2 189,773 acre days
COLL/JAM PLT	11	11 km^2 x14 iterations 154 x 1 density of units 154 x247.1 acres/km^2 38,053 acre days

EW PLT 17

17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10

10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

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100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

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377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB 120
120 km^2
x14 iterations
1680
x 1
1680
x247.1 acres/km^2
415,128 acre days

AVN RECON OPNS 300
300 km^2
x 2 iterations
600
x 3
1800
x247.1 acres/km^2
447,780 acre days

AVN SCREENING OPNS	200	200 km^2 $\underline{\text{x } 6}$ iterations 1200 $\underline{\text{x } 3}$ 3600 $\underline{\text{x}247.1}$ acres/km^2 889,560 acre days

cumulative acre days = 10,255,179

total training days = 14

total training acres required = $\frac{10,255,179}{14}$ = 732,513

ROTATION 93-02
ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB ADV GD	266 + 240	506 km^2 x 1 iterations 506 x 2 density of units 1012 x247.1 acres/km^2 250,065 acre days
MTC/MRB AG	248 + 240	488 km^2 x 1 iterations 488 x 1 density of units 488 x247.1 acres/km^2 120,585 acre days
DATK/MRB DEF	208 + 175	383 km^2 x 3 iterations 1149 x 2 density of units 2298 x247.1 acres/km^2 567,836 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 3 iterations 1326 x 2 density of units 2652 x247.1 acres/km^2 655,309 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 3 iterations 1134 x 1 density of units 1134 x247.1 acres/km^2 280,211 acre days

Enclosure 8

DATK/MRR W/FD	276 + 480	756 km^2 x 2 iterations 1512 x 3 density of units 4536 x247.1 acres/km^2 1,120,846 acre days
DATK/MRB DEF	68 + 175	243 km^2 x 2 iterations 486 x 1 density of units 486 x247.1 acres/km^2 120,091 acre days
SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 3 density of units 360 x247.1 acres/km^2 88,956 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 3 density of units 144 x247.1 acres/km^2 35,582 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days
FA BTRY (105 Towed)	48	48 km^2 x 8 iterations 384 x 1 density of units 384 x247.1 acres/km^2 94,886 acre days

COLL/JAM PLT 11

11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4

4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17

17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10

10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

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100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

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377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB 120
120 km^2
x14 iterations
1680
x 1
1680
x247.1 acres/km^2
415,128 acre days

ATK HEL. CO.	600	600 km² x 3 iterations 1800 x 3 5400 x247.1 acres/km² 1,334,340 acre days

cumulative acre days = 7,797,487

total training days = 14

total training acres required = $\frac{7,797,487}{14}$ = 556,963

ROTATION 93-03
ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB AG	266 + 240	506 km^2 x 1 iterations 506 x 2 density of units 1012 x247.1 acres/km^2 250,065 acre days
DATK/MRB DEF	208 + 175	383 km^2 x 2 iterations 766 x 2 density of units 1532 x247.1 acres/km^2 378,557 acre days
MTC/MRB AG	248 + 240	488 km^2 x 1 iterations 488 x 1 density of units 488 x247.1 acres/km^2 120,585 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 3 iterations 1326 x 2 density of units 2652 x247.1 acres/km^2 655,309 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 3 iterations 1134 x 1 density of units 1134 x247.1 acres/km^2 280,211 acre days

Enclosure 9

DATK/MRR DEF	276 + 375	651 km² x 2 iterations 1302 x 3 density of units 3906 x247.1 acres/km² 965,173 acre days
DATK/MRB DEF	68 + 175	243 km² x 2 iterations 486 x 1 density of units 486 x247.1 acres/km² 120,091 acre days
SPT PLT OPNS (prep day opns)	20	20 km² x 6 iterations 120 x 3 density of units 360 x247.1 acres/km² 88,956 acre days
MED PLT OPNS (prep day opns)	8	8 km² x 6 iterations 48 x 3 density of units 144 x247.1 acres/km² 35,582 acre days
FA BN (155 SP)	270	270 km² x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km² 533,736 acre days
FA BTRY (105 Towed)	48	48 km² x 8 iterations 384 x 1 density of units 384 x247.1 acres/km² 94,886 acre days

COLL/JAM PLT 11

11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4

4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17

17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10

10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

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100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

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377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB	120	120 km^2 $\underline{x14}$ iterations 1680 $\underline{x\ 1}$ 1680 $\underline{x247.1}$ acres/km^2 415,128 acre days

cumulative acre days = 6,118,195

total training days = 14

total training acres required = $\frac{6,118,195}{14}$ = 437,014

ROTATION 93-04
ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB AG	266 + 240	506 km^2 x 1 iterations 506 x 2 density of units 1012 x247.1 acres/km^2 250,065 acre days
MTC/MRB AG	248 + 240	488 km^2 x 1 iterations 488 x 1 density of units 488 x247.1 acres/km^2 120,585 acre days
DATK/MRB DEF	208 + 175	383 km^2 x 2 iterations 766 x 2 density of units 1532 x247.1 acres/km^2 378,557 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 3 iterations 1326 x 2 density of units 2652 x247.1 acres/km^2 655,309 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 3 iterations 1134 x 1 density of units 1134 x247.1 acres/km^2 280,211 acre days

Enclosure 10

DATK/MRR DEF	276 + 375	651 km^2 x 2 iterations 1302 x 3 density of units 3906 x247.1 acres/km^2 965,173 acre days
DATK/MRR DEF	68 + 175	243 km^2 x 2 iterations 486 x 1 density of units 486 x247.1 acres/km^2 120,091 acre days
SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 3 density of units 360 x247.1 acres/km^2 88,956 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 3 density of units 144 x247.1 acres/km^2 35,582 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days
FA BTRY (105 Towed)	48	48 km^2 x 8 iterations 384 x 1 density of units 384 x247.1 acres/km^2 94,886 acre days

COLL/JAM PLT 11 11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4 4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17 17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10 10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB 120

120 km^2
x14 iterations
1680
x 1
1680
x247.1 acres/km^2
415,128 acre days

ATK HEL. CO. 600

600 km^2
x 3 iterations
1800
x 3
5400
x247.1 acres/km^2
1,334,340 acre days

cumulative acre days = 7,452,535

total training days = 14

total training acres required = $\frac{7,452,535}{14}$ = 532,324

ROTATION 93-05
CONOPS/ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB AG	266 + 240	506 km^2 x 1 iterations 506 x 2 density of units 1012 x247.1 acres/km^2 250,065 acre days
MTC/MRB AG	248 + 240	488 km^2 x 1 iterations 488 x 1 density of units 488 x247.1 acres/km^2 120,585 acre days
ATK/PPA SZ	276 + 375	651 km^2 x 2 iterations 1302 x 3 density of units 3906 x247.1 acres/km^2 965,173 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 2 iterations 884 x 2 density of units 1768 x247.1 acres/km^2 436,873 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 4 iterations 1512 x 1 density of units 1512 x247.1 acres/km^2 373,615 acre days

Enclosure 11

DATK/MRB DEF	68 + 175	243 km^2 x 2 iterations 486 x 1 density of units 486 x247.1 acres/km^2 120,091 acre days
DATK/MRB DEF W/SZ	276 + 200	476 km^2 x 2 iterations 952 x 2 density of units 1904 x247.1 acres/km^2 470,478 acre days
DIS/PPA ATK	202 + 240	442 km^2 x 3 iterations 1326 x 3 density of units 3978 x247.1 acres/km^2 982,964 acre days
SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 3 density of units 360 x247.1 acres/km^2 88,956 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 3 density of units 144 x247.1 acres/km^2 35,582 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days

FA BTRY (105 Towed) 48

48 km^2
x 8 iterations
384
x 1 density of units
384
x247.1 acres/km^2
94,886 acre days

COLL/JAM PLT 11

11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4

4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17

17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10

10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB 120
120 km^2
x14 iterations
1680
x 1 density of units
1680
x247.1 acres/km^2
415,128 acre days

ATK HEL. CO. 600
600 km^2
x 6 iterations
3600
x 3 density of units
10800
x247.1 acres/km^2
2,668,680 acre days

MLRS BATTERY 320
320 km^2
x 4 iterations
1280
x 1 density of units
1280
x247.1 acres/km^2
316,288 acre days

cumulative acre days = 10,053,016

total training days = 14

total training acres required = $\frac{10,053,016}{14}$ = 718,073

ROTATION 93-06
ARMOR ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB AG	248 + 240	488 km^2 x 1 iterations 488 x 2 density of units 976 x247.1 acres/km^2 241,170 acre days
MTC/MRB FD	248 + 240	488 km^2 x 2 iterations 976 x 1 density of units 976 x247.1 acres/km^2 241,170 acre days
DATK/MRB DEF	68 + 175	243 km^2 x 5 iterations 1215 x 1 density of units 1215 x247.1 acres/km^2 300,227 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 6 iterations 2268 x 1 density of units 2268 x247.1 acres/km^2 560,423 acre days
DATK/MRR DEF W/SZ	68 + 375	443 km^2 x 1 iterations 443 x 2 density of units 886 x247.1 acres/km^2 218,931 acre days

Enclosure 12

SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 2 density of units 240 x247.1 acres/km^2 59,304 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 2 density of units 96 x247.1 acres/km^2 23,722 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days
COLL/JAM PLT	11	11 km^2 x14 iterations 154 x 1 density of units 154 x247.1 acres/km^2 38,053 acre days
EW PLT	17	17 km^2 x14 iterations 238 x 1 density of units 238 x247.1 acres/km^2 58,810 acre days
INT/SURV PLT	10	10 km^2 x14 iterations 140 x 1 density of units 140 x247.1 acres/km^2 34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB	120	120 km^2 $\underline{\text{x}14}$ iterations 1680 $\underline{\text{x } 1}$ 1680 $\underline{\text{x}247.1}$ acres/km^2 415,128 acre days

cumulative acre days = 4,413,949

total training days = 14

total training acres required = $\frac{4,413,949}{14}$ = 315,282

ROTATION 93-07
ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB FD	248 + 240	488 km^2 x 1 iterations 488 x 1 density of units 488 x247.1 acres/km^2 120,585 acre days
ATK/PPG DEF	68 + 70	138 km^2 x 1 iterations 138 x 1 density of units 138 x247.1 acres/km^2 34,100 acre days
DATK/MRB DEF	208 + 175	383 km^2 x 3 iterations 1149 x 2 density of units 2298 x247.1 acres/km^2 567,836 acre days
DIS/MRB FD	202 + 240	442 km^2 x 1 iterations 442 x 2 density of units 884 x247.1 acres/km^2 218,436 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 3 iterations 1134 x 1 density of units 1134 x247.1 acres/km^2 280,211 acre days

Enclosure 13

DATK/MRR DEF	276 + 375	651 km^2 x 2 iterations 1302 x 3 density of units 3906 x247.1 acres/km^2 965,173 acre days
DATK/MRB DEF	68 + 175	243 km^2 x 2 iterations 486 x 1 density of units 486 x247.1 acres/km^2 120,091 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 2 iterations 884 x 2 density of units 1768 x247.1 acres/km^2 436,873 acre days
SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 3 density of units 360 x247.1 acres/km^2 88,956 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 3 density of units 144 x247.1 acres/km^2 35,582 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days

FA BTRY (105 Towed) 48

48 km^2
x 8 iterations
384
x 1 density of units
384
x247.1 acres/km^2
94,886 acre days

COLL/JAM PLT 11

11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4

4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17

17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10

10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB	120	120 km^2 x14 iterations 1680 x 1 1680 x247.1 acres/km^2 415,128 acre days
ATK HEL. CO.	600	600 km^2 x 4 iterations 2400 x 3 7200 x247.1 acres/km^2 1,779,120 acre days
AVN SCN/GUARD	200	200 km^2 x 2 iterations 400 x 3 1200 x247.1 acres/km^2 296,520 acre days

cumulative acre days = 8,167,149

total training days = 14

total training acres required = $\frac{8,167,149}{14}$ = 583,368

ROTATION 93-08
ARMOR/LIGHT ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC/MRB FD	266 + 240	506 km^2 x 1 iterations 506 x 2 density of units 1012 x247.1 acres/km^2 250,065 acre days
DATK/MRB W/SZ	68 + 375	443 km^2 x 2 iterations 886 x 1 density of units 886 x247.1 acres/km^2 218,931 acre days
DATK/MRB DEF W/SZ	208 + 375	583 km^2 x 2 iterations 1166 x 2 density of units 2332 x247.1 acres/km^2 576,237 acre days
DIS/MRR ATK	202 + 240	442 km^2 x 3 iterations 1326 x 2 density of units 2652 x247.1 acres/km^2 655,309 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 3 iterations 1134 x 1 density of units 1134 x247.1 acres/km^2 280,211 acre days

Enclosure 14

DATK/MRR DEF	276 + 375	651 km^2 x 2 iterations 1302 x 3 density of units 3906 x247.1 acres/km^2 965,173 acre days
MTC/MRB AG	248 + 240	488 km^2 x 1 iterations 488 x 1 density of units 488 x247.1 acres/km^2 120,585 acre days
SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 3 density of units 360 x247.1 acres/km^2 88,956 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 3 density of units 144 x247.1 acres/km^2 35,582 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days
FA BTRY (105 Towed)	48	48 km^2 x 8 iterations 384 x 1 density of units 384 x247.1 acres/km^2 94,886 acre days

COLL/JAM PLT 11

11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

COLL SQD 4

4 km^2
x14 iterations
56
x 1 density of units
56
x247.1 acres/km^2
13,838 acre days

EW PLT 17

17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10

10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

ENG PLT (Light)
mobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
countermobility - 70 km^2 x 3 msn x 1 unit = 210 km^2
survivability - 70 km^2 x 3 msn x 1 unit = 210 km^2
sustainment - 70 km^2 x 8 msn x 1 unit = 560 km^2
fight as Inf. - 70 km^2 x 3 msn x 1 unit = 210 km^2

1400 km^2
x247.1 acres/km^2
345,940 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2

----

100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

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377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB 120
120 km^2
x14 iterations
1680
x 1
1680
x247.1 acres/km^2
415,128 acre days

ATK HEL. CO.	600	600 km² x 4 iterations 2400 x 3 7200 x247.1 acres/km² 1,779,120 acre days
AVN RECON	300	300 km² x 1 iterations 300 x 3 900 x247.1 acres/km² 74,130 acre days
AVN SCN/GUARD	200	200 km² x 2 iterations 400 x 3 1200 x247.1 acres/km² 296,520 acre days

cumulative acre days = 8,564,485

total training days = 14

total training acres required = $\frac{8,564,485}{14}$ = 611,749

ROTATION 94-XX
DIV CAV ROTATION

MISSION	KM^2 REQUIRED	CALCULATIONS
MTC+ZONE RECON/ MRR FD IN MRD SZ	600 + 425	1025 km^2 x 2 iterations 2050 x 2 density of units 4100 x247.1 acres/km^2 1,013,110 acre days
DIS+COVER FORCE/ MRR FD	600 + 900	1500 km^2 x 2 iterations 3000 x 2 density of units 6000 x247.1 acres/km^2 1,482,600 acre days
DATK+SCN/MRB DEF	600 + 175	775 km^2 x 2 iterations 1550 x 2 density of units 3100 x247.1 acres/km^2 766,010 acre days
DATK/MRB DEF	68 + 175	243 km^2 x 2 iterations 486 x 2 density of units 972 x247.1 acres/km^2 240,181 acre days
DIS/MRR ATK	138 + 240	378 km^2 x 4 iterations 1512 x 2 density of units 3024 x247.1 acres/km^2 747,230 acre days

Enclosure 15

ZONE RECON/MRR DEF W/SZ	600 + 375	975 km^2 x 1 iterations 975 x 1 density of units 975 x247.1 acres/km^2 240,923 acre days
COVER/MRR ATK+FD	600 + 480	1080 km^2 x 2 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days
DATK+SCN/MRB DEF W/SZ	668 + 375	1043 km^2 x 2 iterations 2086 x 3 density of units 6258 x247.1 acres/km^2 1,546,352 acre days
SPT PLT OPNS (prep day opns)	20	20 km^2 x 6 iterations 120 x 3 density of units 360 x247.1 acres/km^2 88,956 acre days
MED PLT OPNS (prep day opns)	8	8 km^2 x 6 iterations 48 x 3 density of units 144 x247.1 acres/km^2 35,582 acre days
FA BN (155 SP)	270	270 km^2 x 8 iterations 2160 x 1 density of units 2160 x247.1 acres/km^2 533,736 acre days

COLL/JAM PLT 11
11 km^2
x14 iterations
154
x 1 density of units
154
x247.1 acres/km^2
38,053 acre days

EW PLT 17
17 km^2
x14 iterations
238
x 1 density of units
238
x247.1 acres/km^2
58,810 acre days

INT/SURV PLT 10
10 km^2
x14 iterations
140
x 1 density of units
140
x247.1 acres/km^2
34,594 acre days

ENG CO. CBT
mobility - 96 km^2 x 4 msns x 2 units = 768 km^2
countermobility - 96 km^2 x 3 msns x 2 units = 576 km^2
survivability - 96 km^2 x 3 msns x 2 units = 576 km^2
sustainment - 96 km^2 x 8 msns x 2 units = 1536 km^2
fight as Inf. - 96 km^2 x 8 msns x 2 units = 1536 km^2

4992 km^2
x247.1 acres/km^2
1,233,523 acre days

NBC RECON PLT
NBC recon - 10 km^2 x 4 msns x 1 unit = 40 km^2
NBC survey - 20 km^2 x 3 msns x 1 unit = 60 km^2
----
100 km^2
x247.1 acres/km^2
24,710 acre days

DECON PLT
operate hasty decon - 3 km^2 x 7 msns x 1 unit = 21 km^2
x247.1 acres/km^2
5,189 acre days

SMOKE PLT
provide long smoke - 100 km^2 x 1 msn x 1 unit = 100 km^2
conceal maneuver unit - 126 km^2 x 2 msn x 1 unit = 252 km^2
conceal breaching operation - 25 km^2 x 1 msn x 1 unit = 25 km^2

377 km^2
x247.1 acres/km^2
93,157 acre days

CBT MP PLT
area security - 48 km^2 x 14 msns x 1 unit = 672
battlefield circulaion control - 48 km^2 x 14 msns x 1 unit = 672

1344 km^2
x247.1 acres/km^2
332,102 acre days

FSB 120
120 km^2
x14 iterations
1680
x 1
1680
x247.1 acres/km^2
415,128 acre days

AVN RECON 300
300 km^2
x 2 iterations
600
x 2 density of units
1200
x247.1 acres/km^2
296,520 acre days

AVN SCN/GUARD 200
200 km^2
x 4 iterations
800
x 2 density of units
1600
x247.1 acres/km^2
395,360 acre days

cumulative acre days = 10,155,562

total training days = 14

total training acres required = $\frac{10,155,562}{14}$ = 725,397

Appendix E - 28 Day Rotation Model

DAY	ACTIVITY
-1	Advance party activity
1	Main body deployment/arrival
2	Main body deployment/arrival
3	Equipment issue
4	Equipment issue
5	Equipment issue
6	Equipment issue
7	Equipment issue
8	Move out day (Rotational unit deploys to training area)
9	Training day 1
10	Training day 2
11	Training day 3
12	Training day 4
13	Training day 5
14	Training day 6
15	Training day 7
16	Training day 8
17	Training day 9
18	Training day 10
19	Training day 11
20	Training day 12
21	Training day 13
22	Training day 14 (Rotational unit returns to cantonment area)
23	Unit prepares for equipment turn-in
24	Equipment turn-in
25	Equipment turn-in
26	Equipment turn-in/redeployment
27	Equipment turn-in/redeployment
28	Equipment turn-in/redeployment

Days 1 and 2 are always on Saturday and Sunday respectively

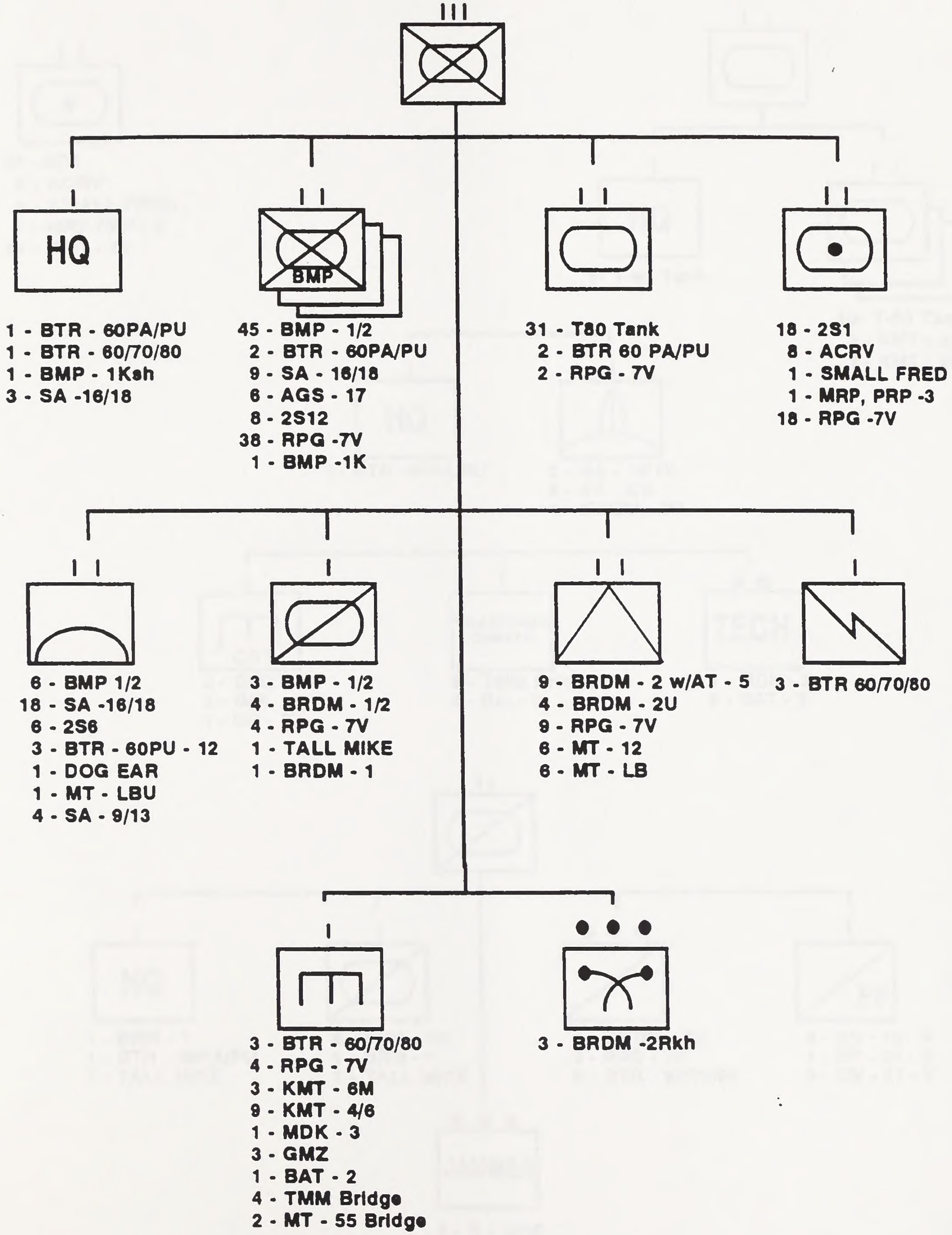
Day 8 is always on Saturday

Day 22 is always on Saturday

Appendix F - National Training Center Opposing Force Organization

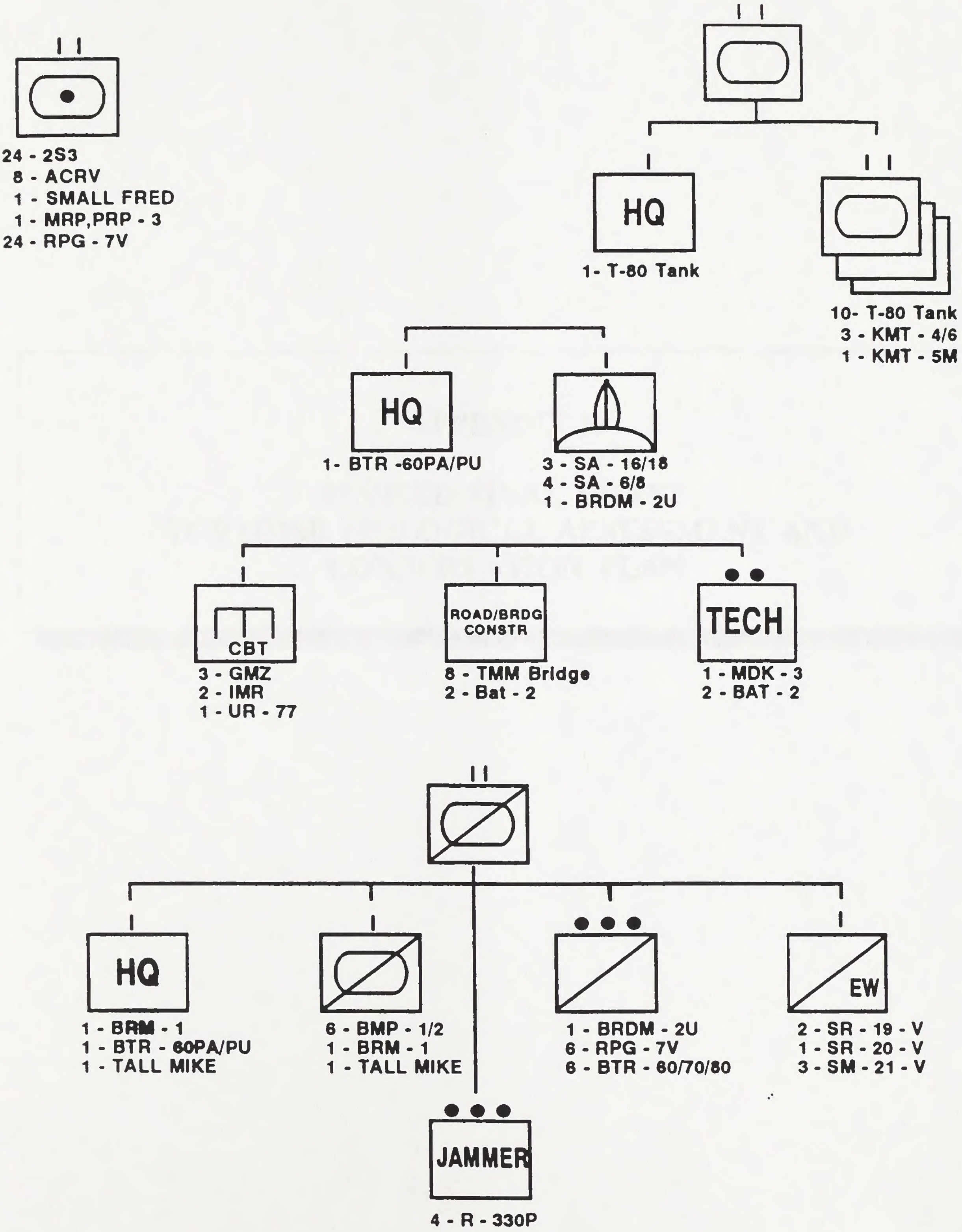
1. NTC OPFOR Motorized Rifle Regiment
2. NTC OPFOR Divisional Assets

NTC OPFOR MOTORIZED RIFLE REGIMENT



Enclosure 1

NTC OPFOR DIVISIONAL ASSETS



Enclosure 2

APPENDIX B

REVISED FINAL DRAFT
TORTOISE BIOLOGICAL ASSESSMENT AND CONSERVATION PLAN

REVISED FINAL

DESERT TORTOISE BIOLOGICAL ASSESSMENT AND CONSERVATION PLAN FOR THE NATIONAL TRAINING CENTER'S LAND ACQUISITION PROJECT

FORT IRWIN, CALIFORNIA

Prepared for:

NATIONAL TRAINING CENTER
Fort Irwin, California 92310

and

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
300 N. Los Angeles Street
Los Angeles, California 90012

OCTOBER 1992

RECYCLED PAPER

EXECUTIVE SUMMARY

This Biological Assessment has been prepared to address the potential impact of the U.S. Army's National Training Center (NTC) Land Acquisition Project on the Desert Tortoise (*Gopherus agassizii*). This species is a "threatened" species in the state of California, and also in Nevada, Utah, and in Arizona (north and west of the Colorado River), under the Endangered Species Act (ESA) of 1973. The land acquisition project involves the acquisition of approximately 478,580 acres (748 square miles) of land adjacent to the existing northern, western, and eastern borders of Fort Irwin. Because of the topographic characteristics of the land and the need to protect certain areas within it, only 238,660 acres (373 square miles) are usable for military training. The Bureau of Land Management (BLM) and the U.S. Army (Army) have contributed to the preparation of this Biological Assessment, which will be used by federal and state agencies charged with the protection of the species.

This report is intended to provide information to the U.S. Fish and Wildlife Service (FWS) to assist in their preparation of a Biological Opinion concerning the effects of the NTC land acquisition project on the desert tortoise in accordance with the requirements of Section 7 of the ESA. This report will also be provided to the California Department of Fish and Game (CDFG) along with a request for conference on potential impacts to the tortoise.

The development of this Biological Assessment is a part of the Environmental Impact Statement (EIS) being prepared for both NTC's Land Acquisition Project and an amendment to the California Desert Conservation Area Plan. It is intended to fulfill the compliance requirements of pertinent environmental laws, regulations, and agency policies, and considers known public interest and concerns. The scope of this effort has been to avoid agency duplication (two separate EIS documents) and is consistent with more detailed information which is included in separate EIS supporting documentation being prepared for the BLM and the NTC. This Biological Assessment is limited to addressing the potential impact on the Mojave population of the desert tortoise that is expected as a result of the implementation of the project. No other species within the study area are currently listed under the authority of the ESA.

The Army determined in a Land Use Requirements Study (LURS) completed in 1985, that the NTC cannot accommodate current training needs adequately due to a lack of maneuver acreage to sufficiently allow for realistic brigade-sized training. Additionally, the General Accounting Office recently validated the NTC requirement (GAO, 1990). The LURS concluded that the U.S. Army's National Training Center required an additional 238,000 net maneuverable acres in operational lands.

Based on input provided by the FWS, the proposed action has been fully redesigned to avoid tortoises and high value tortoise habitat to the south of the NTC. The NTC now proposes to acquire land in an easterly direction through portions of the Soda Mountains, Silurian Valley and Valjean Valley and to maneuver on a portion of the U.S. Navy's Mojave B Range west of the NTC. Total acreages affected in this proposed action includes 327,150 acres east of the NTC and 148,870 acres within the Mojave B Ranges. Additionally, the NTC proposes to acquire 2,560 acres south of the NTC to manage for protection of the tortoise and to prevent human injury by restricting access to abandoned mine shafts.

Implementation of the land acquisition project would result in the loss of 32,787 acres of tortoise habitat. On a worst case basis, there would be a loss of 1,070 tortoises within the eastern portion of the acquisition area and 196 tortoises within the Mojave B Ranges. These losses would be both from the incidental take of tortoises as well as habitat loss if none of the proposed mitigation measures were implemented.

In order to conserve both animals and habitat, the NTC plans to implement a wide range of mitigating conservation measures. They will protect sensitive habitat areas and fence boundaries of the area where necessary to reduce mortality of tortoises in habitat areas outside of the boundary area. It is also proposed that a phased removal and translocation of tortoise be undertaken for those individuals impacted by military operations. The NTC has also committed to an extensive research program to study both the health aspects and the overall ecology of the species.

Following the implementation of the conservation plan described, and as a result of the revised operational boundaries to the east, north, and west, which includes the initial preservation of and the limitation of maneuvers in the Valjean Valley, approximately 420 tortoises would be subject to scientific and incidental take. This is 0.08-0.14 percent of the listed population (308,465-530,688 animals). If relocation of tortoises from the Valjean and Silurian Valleys is approved then an additional 650 tortoises would be subject to scientific take. This represents approximately 0.12-0.21 percent of the listed population. Thus, the potential total impact to the listed population would be 0.20-0.35 percent (1,070 tortoise) following relocation of tortoises from the acquisition area. It is believed that significant scientific data will be accumulated as a result of the implementation of the land acquisition project's conservation plan. Collection of this valuable information is likely to positively affect the management of the listed species as FWS, BLM and NTC cooperatively pursue enhancing the chances for the continued survival of the desert tortoise.

REVISED FINAL DESERT TORTOISE BIOLOGICAL ASSESSMENT AND CONSERVATION PLAN FOR THE NATIONAL TRAINING CENTER'S LAND ACQUISITION PROJECT FORT IRWIN, CALIFORNIA

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SECTION 1 - INTRODUCTION

This Revised Biological Assessment has been prepared to address the potential impact of the U.S. Army's National Training Center (NTC) Land Acquisition Project, on the Mojave population of the desert tortoise (*Gopherus agassizii*). This population of the desert tortoise is a "threatened" species listed under the Endangered Species Act (ESA) of 1973, as amended. The expansion of the NTC would involve the acquisition and use of approximately 478,580 acres (747.8 square miles) of land adjacent to existing property at Fort Irwin, California. The Bureau of Land Management (BLM) as the agency responsible for processing land use applications on public land, and the U.S. Army (Army) as the applicant agency, have contributed to the preparation of this Biological Assessment for use by Federal and state agencies charged with protection of the species.

This report is intended to provide the information to the U.S. Fish and Wildlife Service (FWS) to assist their preparation of a Biological Opinion concerning the effects of the NTC Land Acquisition project on the desert tortoise, in accordance with requirements of Section 7 of the ESA. This report will also be provided to the California Department of Fish and Game (CDFG) along with a request for conference on potential impact to the tortoise.

A Final Biological Assessment and Conservation Plan was prepared in June 1991 and submitted to the FWS. That Biological Assessment addressed the potential impact of expansion of NTC by approximately 328,660 acres to the south of the installation. The alternative known as the Modified Coyote Alternative was assessed by the FWS. In its Draft Biological Opinion issued in September 1991, the FWS determined that the Modified Coyote Alternative would be likely to jeopardize the continued existence of the desert tortoise.

Subsequent to the issuance of this draft jeopardy opinion, NTC undertook several steps to modify its proposal in an effort to reduce the impact to the desert tortoise. The proposed alternative outlined in this Biological Assessment has been carefully developed to allow for the needed expansion to fulfill the mission of NTC while reducing the impact to the desert tortoise. This alternative involves the expansion of the facility by 327,150 acres (511.2 square miles) to the east of NTC within the Soda Mountains and Silurian Valley and the joint use with the U.S. Navy of approximately 148,870 acres (232.6 square miles) within the central portion of the Navy's Mojave B Range. It also involves the expansion into approximately 2,560 acres (4 square miles) just south of the NTC and east of Fort Irwin Road for management of the tortoise habitat in that area and for prevention of human injury by restricting access to abandoned mine shafts.

1.1 SCOPE

This Biological Assessment has been prepared consistent with the ESA and additional guidance provided by FWS. It will be included in the Environmental Impact Statement (EIS) being prepared for both the NTC Land Acquisition Project (Army) and the California Desert Conservation Area Plan Amendment (BLM). It is intended to fulfill the compliance requirements of pertinent environmental laws and regulations [e.g., National Environmental Policy Act of 1969 (NEPA), Endangered Species Act (ESA), Engle Act of 1958, Federal Land Policy and Management Act of 1976], agency policies, and considers known public interest and concerns. The scope of this effort has been developed to avoid agency duplication and is consistent with more detailed information which is included in separate EIS supporting documentation being prepared for the BLM and NTC. This Biological Assessment is limited to addressing the potential impact on the Mojave population of the desert tortoise expected as a result of implementation of the proposed action. Since no other species within the study area are currently listed under authority of the ESA, none are discussed herein.

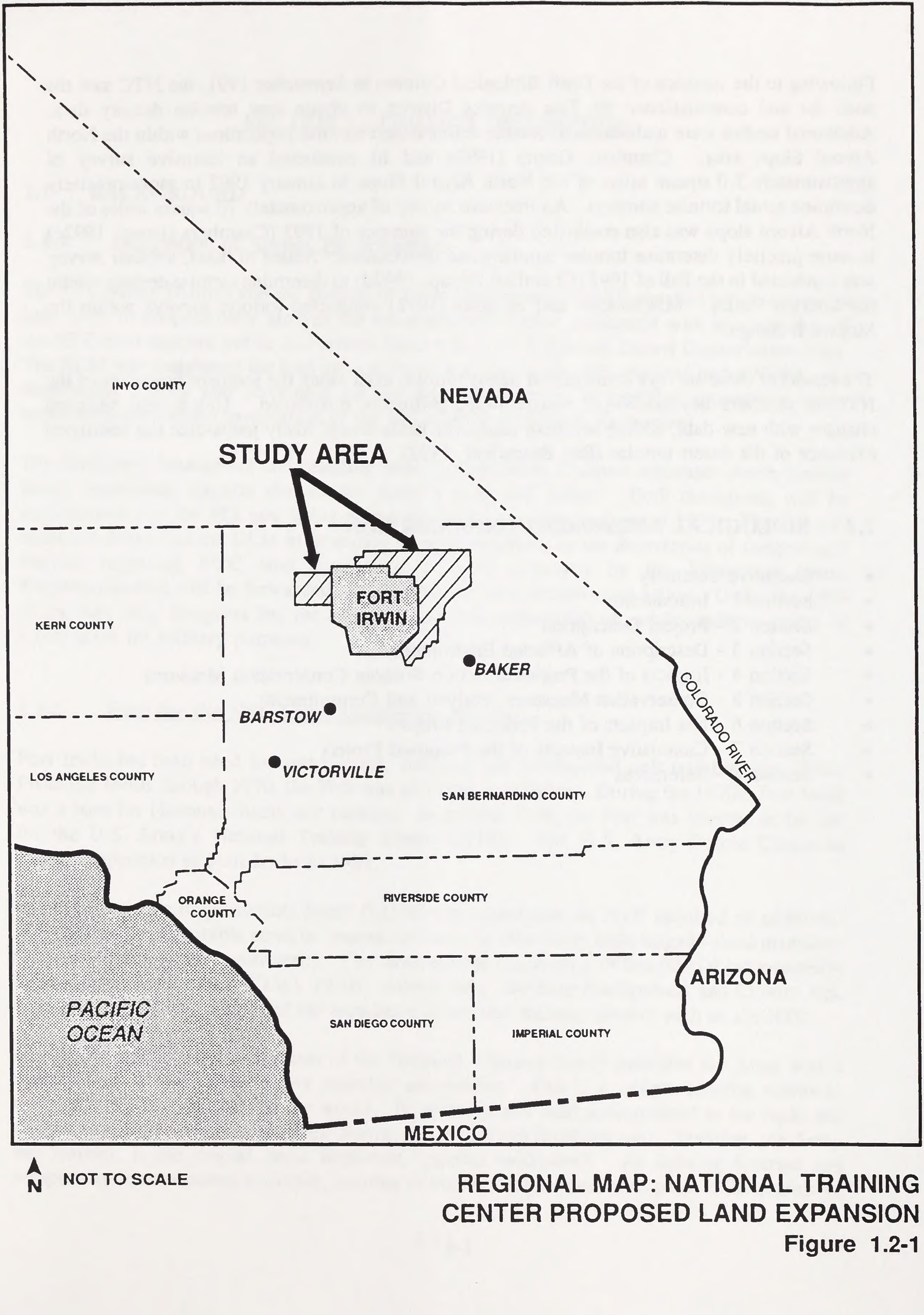
1.2 STUDY AREA LOCATION

The National Training Center (NTC) is located within the Western Mojave Desert of California (Figure 1.2-1). The study area is northeast of Barstow and north of Interstate 15, east, west, and south of the existing boundaries of the NTC. While approximately 747.8 square miles are included in the basic land acquisition study area, the desert tortoise cumulative impacts studies covered a broader area as described below.

The proposed land acquisition area consists of approximately 327,150 acres (511.2 square miles) on the eastern border of the NTC as shown in Figure 1.2-1. The study area consists of the Soda Mountain area proceeding northeast from Dunn Road, some 20 miles to the Silurian Valley. An additional 148,870 acres (232.6 square miles) is proposed for joint use by the U.S. Army and Navy within the central portion of the Mojave B Range. The Mojave B Range is located directly west of NTC. An additional 2,560 acres (4 square miles) south of the NTC and east of Fort Irwin road will also be incorporated into the project.

1.3 RELATED STUDIES

A number of related studies have been conducted that were designed to characterize tortoise habitat, tortoise density and the level of disturbance. Surveys conducted in 1988 and 1990 estimate the distribution and density of tortoise in the study area and an isolation area near Interstate 15. A cumulative impacts study was conducted in 1990 to determine the quantity and condition of remaining tortoise habitat within the Western Mojave Desert. In 1991, a conservation biology study produced a set of population viability models specifically designed to address issues of desert tortoise population dynamics and to guide future management. Results of each of these studies were applied to assist in determining potential impacts of the proposed NTC land acquisition on the desert tortoise.



REGIONAL MAP: NATIONAL TRAINING CENTER PROPOSED LAND EXPANSION

Figure 1.2-1

Following to the issuance of the Draft Biological Opinion in September 1991, the NTC saw the need for and commissioned the Los Angeles District to obtain new tortoise density data. Additional studies were undertaken to further define desert tortoise populations within the North Alvord Slope area. Chambers Group (1992a and b) conducted an intensive survey of approximately 3.0 square miles of the North Alvord Slope in January 1992 to more precisely determine actual tortoise numbers. An intensive survey of approximately 70 square miles of the North Alvord slope was also conducted during the summer of 1992 (Chambers Group, 1992c) to more precisely determine tortoise numbers and distribution. Added to these, another survey was conducted in the Fall of 1992 (Chambers Group, 1992d) to determine tortoise density within the Silurian Valley. McClanahan and Hopkins (1991) conducted tortoise surveys within the Mojave B Range.

The results of these surveys confirm that desert tortoise exist along the southern boundary of the NTC in numbers beyond 20 per square mile, uniformly distributed. Unless that situation changes with new data, adding southern maneuver lands would likely jeopardize the continued existence of the desert tortoise (Ray Bransfield, 1992).

1.4 BIOLOGICAL ASSESSMENT ORGANIZATION

- Executive Summary
- Section 1 - Introduction
- Section 2 - Project Description
- Section 3 - Description of Affected Environment
- Section 4 - Impacts of the Proposed Action Without Conservation Measures
- Section 5 - Conservation Measures Analysis and Commitments
- Section 6 - Net Impacts of the Proposed Project
- Section 7 - Cumulative Impacts of the Proposed Project
- Section 8 - References

SECTION 2 - PROJECT DESCRIPTION

2.1 BACKGROUND

2.1.1 Description of Agency Participation

The U.S. Army (Army) and the Bureau of Land Management (BLM) reached an agreement in June 1988 to cooperatively analyze the environmental impact associated with an expansion of the NTC onto adjacent public and private lands within the California Desert Conservation Area. The BLM was designated the lead agency for preparation of the EIS required under NEPA. As cooperating agency and proponent for the action, the Army is applying appropriate Army regulations concerning preparation of the EIS and the Biological Assessment.

The Biological Assessment and resulting Biological Opinion rendered addresses desert tortoise issues concerning impacts due to the Army's proposed action. Both documents will be incorporated into the EIS now being prepared for draft review in January 1993. The EIS will assist the Army and the BLM in preparing recommendations to the Secretaries of Defense and Interior regarding NTC land acquisition. When approved by the Secretaries, these recommendations will be forwarded to Congress for consideration and action. Under the 1958 Engle Act, only Congress has the authority to allow withdrawal of public lands in excess of 5,000 acres for military purposes.

2.1.2 Need for the NTC Land Acquisition Project

Fort Irwin has been used for anti-aircraft, armored and mechanized unit training since 1940. From the 1940s through 1970, the Fort was an Army installation. During the 1970s, Fort Irwin was a base for National Guard unit training. In August 1979, the Fort was selected as the site for the U.S. Army's National Training Center (NTC). The U.S. Army Forces Command resumed operation of Fort Irwin in 1981.

A 1985 Land Use Requirements Study (LURS) concluded that the NTC required an additional 238,000 net maneuverable acres in operational lands to effectively train brigade-sized maneuver units to achieve combat proficiency. The Government Accounting Office (GAO) independently validated this requirement (GAO, 1990). Additionally, the Base Realignment and Closure Act, Public Law 100-526, supported the expansion of combat training centers such as the NTC.

During the 1980s, the development of the National Training Center provided the Army with a critical edge in training over any potential adversaries. This is a unique training resource, unduplicated anywhere else in the world. Its efficacy was well substantiated in the rapid and decisive ground operations of Desert Storm, in Kuwait and Southern Iraq. Training, the Army has learned, is the crucial, most important "combat multiplier". As fighting doctrine and weapons systems continue to evolve, training of military forces must keep pace, if the qualitative edge is to be maintained. This is the purpose of the NTC acquisition proposal, the Army's number one priority land project.

Fort Irwin is the world's premier site for combat unit training. As demonstrated by the success of our soldiers in the Gulf War, an Army fights as it trains. Most of the combat soldiers in the Gulf theater received their most realistic training at the NTC. Twelve times per year soldiers from all over the United States rotate to Fort Irwin for training. However, to accommodate rapidly evolving changes in tactics, weapons, equipment, and vehicles, Fort Irwin must expand in order to realistically train the Army of the future.

Why is the current maneuver space inadequate? A primary reason is the change in tactics and doctrine. Modern U.S. war fighting doctrine, known as AirLand Operations, is influenced by the continued modernization and technological advances of U.S. forces and potential adversaries. The static front lines of World War II and Korea have given way to the fluid 100-mile-deep rear, main, and forward battle areas of the Persian Gulf. From training at the NTC, and our experience in Operation Desert Storm, the Army realizes that future battlefields will be controlled by commanders who have at their disposal a wide variety of highly mobile ground and air platforms whose training must be conducted at doctrinally correct distances.

The ability of modern U.S. forces to fight the AirLand Operations over vast areas results from an ever-improving array of vehicles, weapons, and equipment. For example, the M1A1 battle tank can, while moving 45 miles per hour, accurately hit targets which are over 1½ miles away. Apache helicopters can accurately engage targets at a distance of over 5 miles. The Multiple Launch Rocket System can hit targets over 20 miles away. Modern communication equipment allows commanders to simultaneously command and control all subordinate elements throughout the full range of the modern battlefield. The speed, accuracy, and lethality of modern weapons forces units to widely disperse until it is tactically advantageous to mass forces to attack or defend. Moreover, as the vehicles, equipment, and weapons of the Army and its potential adversaries improve, the modern battlefield will become evermore fluid. Thus acquisition of additional land is necessary.

Unless reconnaissance units can learn to patrol realistic distances and detect realistically dispersed enemy units, unless logisticians can learn to supply combat units from realistically distant supply bases, and unless commanders at all levels can learn to field and control realistically-dispersed units, they will not be effective in combat. The lessons learned from training at doctrinally-correct distances are crucial to accomplishing the Army's mission should it be called upon in future conflicts.

Those familiar with the contours and size (1,000 square miles, 642,000 acres) of Fort Irwin might ask why an installation that size lacks adequate maneuver space? In the first place, Fort Irwin's boundaries were first established in 1940 for an anti-aircraft training base, and after periodic reactivation, the NTC was established in 1981 within these original boundaries. In just those 10 years, however, tactics and doctrine have changed radically and vehicles, weapons, and equipment have improved dramatically. Secondly, Fort Irwin is a multi-purpose facility. NASA operates an important deep space and satellite tracking facility on 46,436 acres of Fort Irwin land. The Air Force conducts critical live-fire bombing operations on 92,626 acres of Fort

Irwin land. Furthermore, steeply-sloping mountain ranges, as well as protected environmentally sensitive areas and archaeological sites preclude training on over 100,000 additional acres. In sum, after factoring in buffer zones which prevent boundary crossings, only 55 percent of Fort Irwin land is available for training.

The training center's expansion requirements have not changed since the 1985 Department of Defense LURS study which found the training center's expansion to be justified. What has changed are the areas being considered for expansion, several of which have been proposed by the Bureau of Land Management.

The Army, and particularly the command at Fort Irwin, are concerned that the public, federal and state agencies and our neighbors in Barstow and the High Desert understand the reasons for expansion. All are committed to ensuring that Fort Irwin remains a good neighbor, a good economic partner, and a responsible steward of the High Desert environment.

2.1.3 Alternatives Eliminated from Further Consideration

As noted above, the Army and GAO have concluded that the NTC cannot accommodate current training needs due to a lack of maneuver acreage to sufficiently allow for realistic brigade-sized training. To effectively train a brigade-sized force in AirLand Battle-Future doctrine, the U.S. Army's National Training Center requires additional contiguous land. The following paragraphs summarize alternatives that were eliminated from further consideration.

- No-Action. Army training would continue within current NTC boundaries. No withdrawal of additional public lands or acquisition of private land would occur. Management of public lands including desert tortoise habitat, would continue under the California Desert Conservation Area Plan, as amended; and would be subject to other applicable laws.

- The Coyote Basin Alternative (281,300 acres). This alternative includes the south slope of the Avawatz Mountains, the west slope of the Soda Mountains, 35.5 miles of the Boulder Corridor and 2.7 miles of Utility Corridor Q, Alvord Mountain and Spanish Canyon, the plain south of Alvord Mountain including Coyote Lake, the north slope of the Calico Mountains, the slopes and plain east of Lane Mountain, the Paradise Range and Paradise Springs, and the area north of the Paradise Range to Goldstone.

- The Alvord Alternative (210,800 acres). This alternative includes the south slope of the Avawatz Mountains, the west slope of the Soda Mountains, 35.5 miles of the Boulder Corridor, Alvord Mountain and Spanish Canyon, the plain south of Alvord Mountain, and the area north of the Paradise Range to Goldstone.

- The Superior Valley Alternative (284,885 acres). The area that would be acquired includes the south slope of the Avawatz Mountains, all lands west of the existing Boulder Corridor (within the study area), Alvord Mountain and Spanish Canyon, 2.7 miles of Corridor Q, the north slope of the Calico Mountains, the Coyote Lake Basin, Lane

Mountain, Mud Hills (north of Rainbow Basin), the northeast end of Fossil Canyon, the Copper City Area, the Paradise Range, Superior Valley, both of the Superior Lakes and the Goldstone area.

- The Wilderness Study Area Exclusion Alternative (252,985 acres). This alternative includes Alvord Mountain and Spanish Canyon, the plain south of Alvord Mountain, the Coyote Lake Basin, Lane Mountain, Mud Hills (north of Rainbow Basin), the northeast end of Fossil Canyon, the Paradise Range and Paradise Springs, Superior Valley, both of the Superior Lakes, the Goldstone area, and 2.7 miles of Utility Corridor Q.

- The Avawatz Alternative (185,500 acres). This alternative includes the south slope of the Avawatz Mountains, Alvord Mountain and Spanish Canyon, the plain south of Alvord Mountain, the Coyote Basin, the Paradise Range & Paradise Springs, and the Goldstone Area.

- The Modified Coyote Basin Alternative (328,660 acres). This alternative includes the south slope of Avawatz Mountains, the west slope of the Soda Mountains, 35.5 miles of the Boulder Corridor and 2.7 miles of Utility Corridor Q, Alvord Mountain and Spanish Canyon, the plain south of Alvord Mountain including Coyote Lake, the Paradise Range and Paradise Springs, the area north of the Paradise Range to Goldstone, Lane Mountain, Mud Hills (north of Rainbow Basin) and the northeast end of Fossil Canyon. This alternative was the Proposed Action in the June 1991 Biological Assessment.

- Leach Lake Gunnery Range, Fort Irwin (within existing Fort Irwin northern boundary). This range is currently used by Navy and Air Force air elements whose mission cannot be conducted elsewhere.

- Marine Corps Air Ground Combat Center, Twenty-nine Palms, California (southeast of Fort Irwin). This space is not contiguous with current maneuver corridors and its separation rules it out for consideration.

- Other Non-Adjacent or Out of State Military Lands. These lands are not contiguous and would not meet the NTC mission requirements.

- Adjacent land to the north and east of the existing installation outside of the current study area. Areas toward Baker were considered but ruled out because, alone they could not connect existing maneuver corridors, and they would require the closure of the Leach Lake Gunnery Range. Use of these lands, by themselves, was found to be not practicable due to terrain and corridor constraints.

- Increased use of simulation training. Although simulation use has become more effective in the past few years, it is used to enhance - not replace - field training. There is no simulation available for tough, realistic combined arms training at the NTC. Acquisition of land as recommended is required to complete the training mission.

2.2 FWS REASONABLE AND PRUDENT ALTERNATIVES

In its September 20, 1991 Draft Biological Opinion, the FWS identified the following reasonable and prudent alternatives:

1. a. Acquire and conduct training exercises only in that portion of the modified Coyote Basin Alternative east and north of the Soda Mountains; and relocate the existing cantonment area and ranges to non-desert tortoise habitat either within or outside the existing National Training Center. The abandoned agricultural land near Harvard would be a potential relocation site for cantonment facilities.

OR

b. Develop and analyze an additional expansion alternative that would extend from the east face of the Soda Mountains northeast into the Silurian Valley.

AND

2. Reduce the take of individual desert tortoises in areas that would be affected by the previous reasonable and prudent alternatives through a combination of measures including habitat protection and translocation of animals to protected areas on the National Training Center.

The proposed action roughly follows the 1b element of the identified reasonable and prudent alternative. Land acquisition is now proposed within the Silurian Valley with an additional area proposed for joint use within the U.S. Navy's Mojave B Range. Conservation and mitigation measures will be proposed within portions of the land acquisition area.

2.3 PROJECT DESCRIPTION AND LOCATION

The NTC's Proposed Action is to acquire land area of approximately 327,150 acres (511.2 square miles) east of the NTC from Dunn Road, northward past the Soda Mountains through the Silurian Valley, and eastward to the Valjean Hills. Since this acreage would not provide adequate areas for training, it is proposed that approximately 148,870 acres of the central portion of the U.S. Naval Weapons Center, China Lake Randsburg Wash/Mojave B Test Range Complex also be used. An additional 2,560 acres of land adjacent to the southern boundary of Fort Irwin and east of Fort Irwin Road would also be included in the project. Of all previous alternatives, the proposed alternative would best satisfy the mission of the NTC while minimizing impacts to the desert tortoise.

SECTION 3 - DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 PHYSICAL ENVIRONMENT AND LOCATION

The NTC Land Acquisition Project encompasses areas adjacent to Fort Irwin and extends primarily to the east and to the west. Figure 3.1-1 shows a topographic map of Fort Irwin and the proposed expansion area. A small (approximately 4.0 square mile) area along Fort Irwin road is included in an effort to protect biologically sensitive tortoise habitat from further encroachment due to mining and off-road vehicle disturbances. Additionally, lands north and northeast are sought in order to provide a northern access corridor around the Avawatz Mountains. The area is typical of much of the Western Mojave Desert. The eastern section includes the western extension of the Soda Mountains, the east slope of the Avawatz Mountains and associated bajadas, as well as the many washes which dissect the area. These eastern lands extend through the Silurian Valley to the Valjean Foothills. For the most part, this low valley area is level, rocky and sparsely vegetated.

Areas of proposed acquisition to the west within China Lake Naval Testing Station, are mostly mountainous, but the large central Pilots Knob Valley is suitable for training purposes. These lands are better described in China Lake's biological assessment for the Navy's ongoing mission. These lands are already under Department of Defense stewardship. While the current no-jeopardy opinion on adverse effects to endangered species in this area does not automatically extend to encompass Army training, it can be argued that these effects will be minimal on the isolated desert tortoise population on the western extension of the Granite Mountains.

Figure 3.1-2 shows a topographic map of the proposed Silurian Valley/Mojave B Range acquisition area with shading in those areas consisting of greater than a 20 percent slope. Any areas having a slope of above 20 percent are not considered maneuverable and thus would not be affected by the actions of tanks in the study area. Thus, if these non-maneuverable lands, approximately 201,439 acres (314.75 square miles), are deducted from the total area encompassed by the proposed acquisition area boundaries, the total net maneuverable lands within the boundary is 277,141 acres (433.03 square miles). Even though this total maneuverable area is larger than the required 238,000 net maneuverable acres required for the expansion, it must be made clear that the area within the Mojave B Range of the China Lake Naval Weapons Center would not all be utilized at any given time. Thus, the only portions of the proposed action that would actually be a new acquisition for the Department of Defense are the Silurian Valley and the 4 square miles at the southern boundary. The remainder of the lands, within the Mojave B Range, have already been withdrawn by Congress for the Department of Defense. One point that must be made clear is that the 4 square miles at the southern boundary of Fort Irwin are not proposed for maneuver lands due to the fact that, in NTC's current mission biological opinion, all lands below the ninetieth parallel are restricted from maneuvers.

SECTION 3 - DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 PHYSICAL ENVIRONMENT AND LOCATION

The NTC Land Acquisition Project encompasses areas adjacent to Fort Irwin and extends primarily to the east and to the south. Figure 3.1-1 shows a topographic map of Fort Irwin and the proposed expansion area. A small (approximately 4.0 square mile) area along Fort Irwin road is included in an effort to protect biologically sensitive tortoise habitat from further encroachment due to troop and off-road vehicle disturbances. Additionally, lands north and southeast are sought in order to provide a southern access corridor around the Avawatz Mountains. The land is typical of much of the Western Mojave Desert. The eastern border includes the western extension of the Soda Mountains, the east slope of the Avawatz Mountains and associated foothills, as well as the many washes which dissect the area. These eastern lands extend south of the Silurian Valley to the Virgin Foothills. For the most part, this low valley area is both rocky and sparsely vegetated.

Areas of proposed acquisition to the west within China Lake Naval Training Station, are mostly unoccupied. But the large, Coyote Mine, Leach Valley is suitable for training purposes. These lands are being developed as China Lake's biological sanctuaries for the Navy's ongoing mission. These lands are already under Department of Defense stewardship. While the current use recently resulted in adverse effects to endangered species in this area, and are consequently unsuited to contemplated Army training, it can be argued that these lands will be retained as the biological design tract for preservation on the western extension of the Granite Mountains.

Figure 3.1-2 shows a topographic map of the proposed Silurian Valley/Mojave B Range acquisition area with shading of those areas consisting of greater than a 20 percent slope. Any areas having a slope of above 20 percent are not considered maneuverable and thus would not be affected by the actions of units in the study area. Thus, if these non-maneuverable lands, approximately 249,472 acres (389.79 square miles), are subtracted from the total area encompassed by the proposed acquisition area boundaries, the total net maneuverable land, would be currently 277,141 acres (433.03 square miles). Even though the total maneuverable area is larger than the required 278,000 net maneuverable acres required for the expansion, it should be made clear that the area within the Mojave B Range of the China Lake Naval Weapons Center would not all be utilized at any given time. Thus, the only portion of the proposed action that would actually be a new acquisition for the Department of Defense are the Silurian Valley and the 4 square miles at the southern boundary. The remainder of the lands within the Mojave B Range have already been withdrawn by Congress for the Department of Defense. One point that must be made clear is that the 4 square miles at the southern boundary of Fort Irwin are not proposed for maneuver lands due to the fact that, in NTC's current scenario throughout options, all lands below the absolute parallel are restricted from maneuvers.

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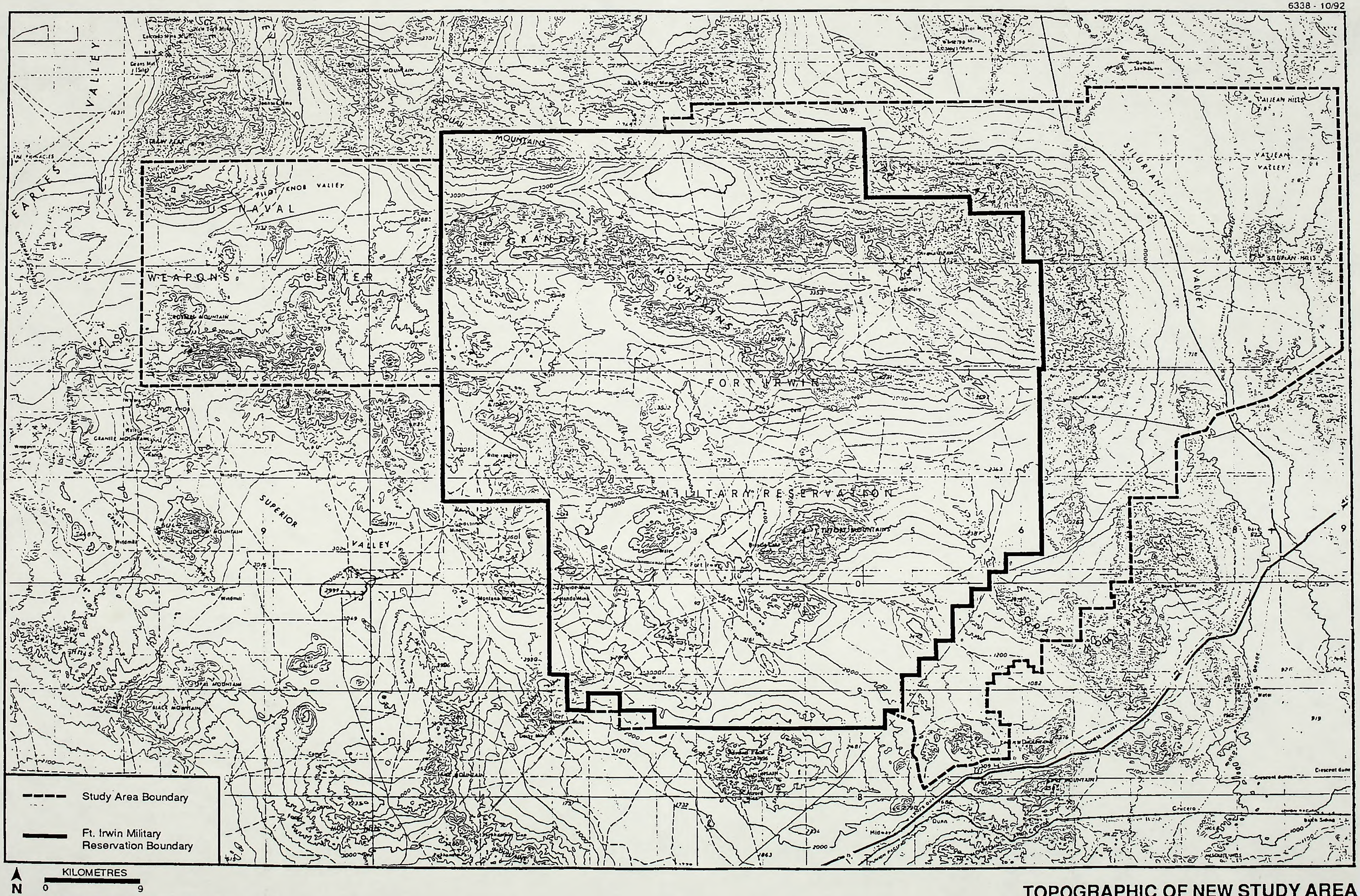
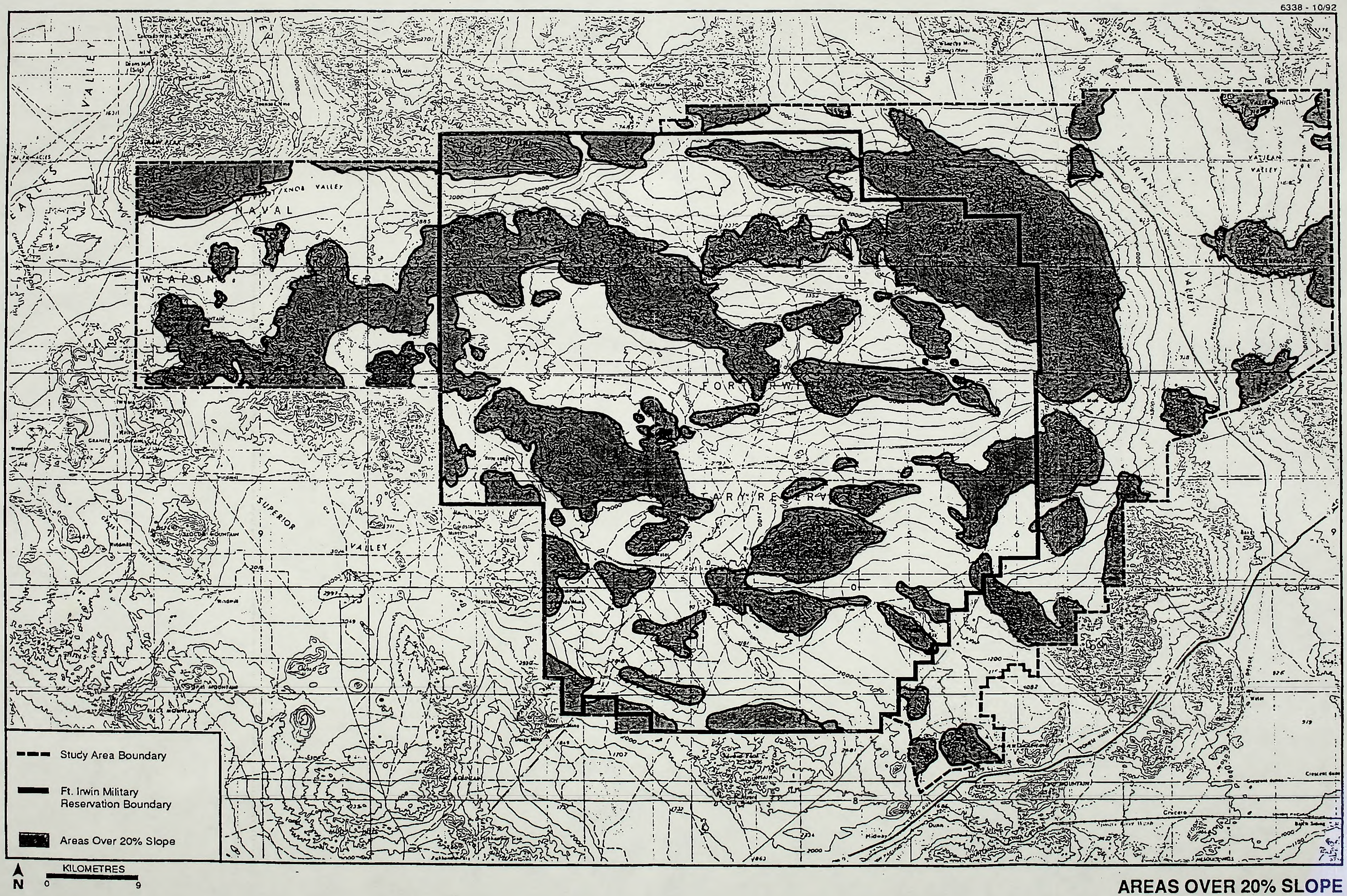


SOURCE: USGS 1:250,000 • TRONA, CA

TOPOGRAPHIC OF NEW STUDY AREA
Figure 3.1-1



AREAS OVER 20% SLOPE
Figure 3.1-2

The project area lies entirely within the Mojave Desert province of California. This area is characterized by hot summers, mild winters, and a very dry climate. Average annual precipitation in the study area is approximately 3 to 4 inches of rainfall. Most precipitation falls between October and February, however, during the last 3 years scattered summer thunderstorms (July through September) have occurred in parts of the project area. The area has been subject to 5 years of drought (below average precipitation) as has all of California, although heavy rains did occur in March 1991 and 1992.

3.2 LAND USE AND OWNERSHIP

The California Desert Conservation Area was designated by Congress in the Federal Land Policy and Management Act of 1976 (FLPMA). The California Desert Conservation Area Plan of 1980 (CDCAP), as amended, directs multiple-use management of public lands in this area of the Western Mojave.

Figure 3.2-1 shows the land ownership within the Silurian Valley/Mojave B Range Acquisition area. Public lands managed directly by the BLM comprise approximately 306,298 acres (64.0 percent) of the study area. The land ownership is mostly public throughout the Silurian Valley portion of the study area. Current land uses include:

- Mining near Dunn Road at the southern portion of the study area and in the Avawatz Mountains, Silurian Hills, and Valjean Hills. Historically, mining also occurred in portions of the 4 square miles located along the southern boundary of the NTC.

- A major utility transmission corridor (Boulder Corridor) runs through the southern and eastern portions of the Silurian Valley part of the study area. Those study lands southeast of the corridor is intended for logistical support and administrative uses, not force on force tactical maneuvering.

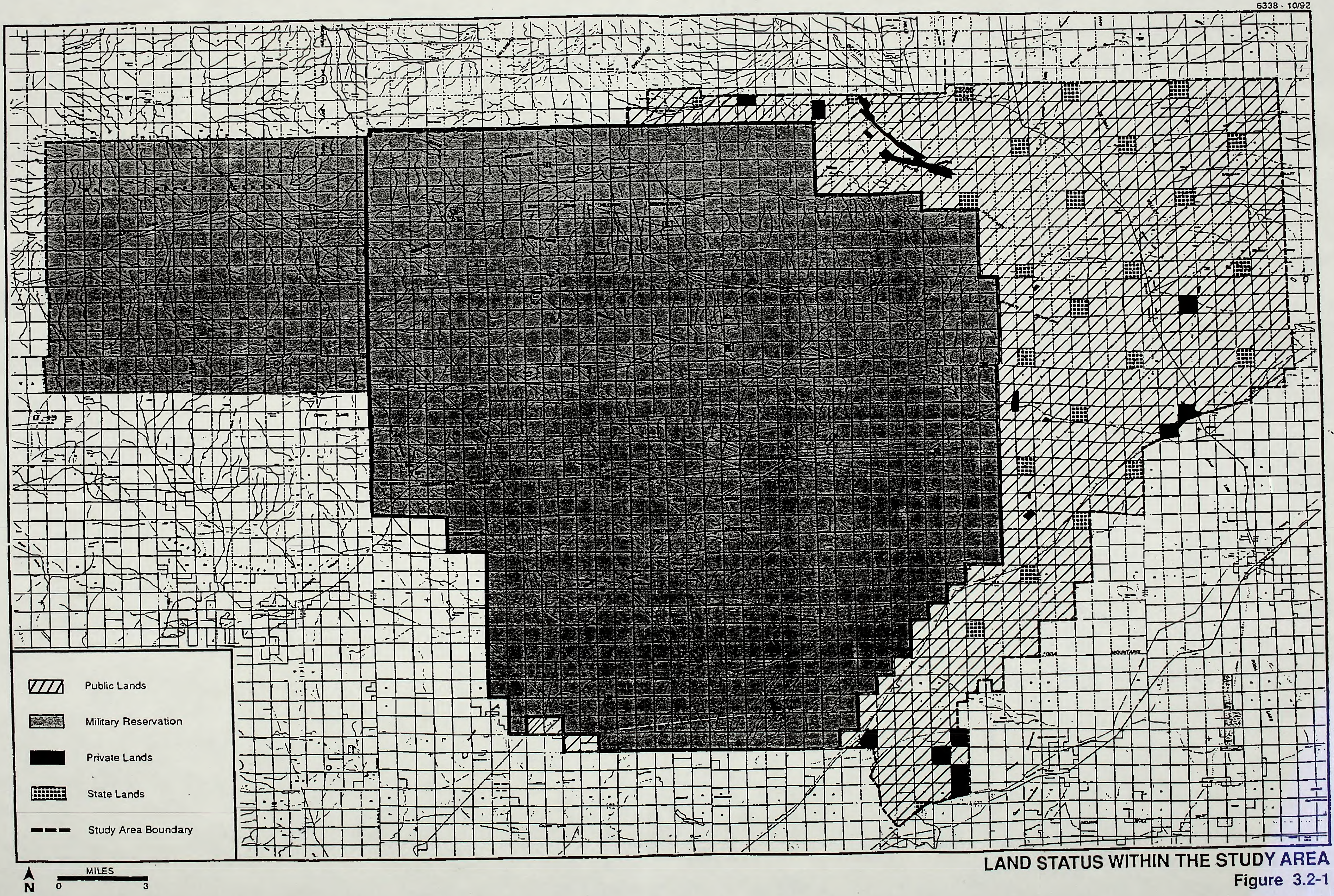
- A natural gas pipeline parallels the Boulder Corridor, just south of the study area boundary.

- Dispersed recreation (rockhounding, sightseeing, and limited Off-Highway Vehicle use (OHV) mostly in the Silurian Valley portion of the study area.

- California Highway 127 traverses bisects the Silurian Valley portion of the study area. Training on both sides of the highway is planned with approximately six specifically constructed cross points for tracked vehicles. Vehicle turn-outs for civilian traffic to observe training are also part of the plan.

- Death Valley National Monument lies adjacent to a portion of the northern boundary of the study area.

- A portion of the Amargosa River drainage lies within the northern boundary of the study area.



LAND STATUS WITHIN THE STUDY AREA
Figure 3.2-1

- The Cronese Basin Area of Critical Environmental Concern (ACEC) adjoins the southeastern corner of the study area.

- The Salt Creek and Denning Springs ACECs are located within the northern boundary of the study area.

- All or portions of seven Wilderness Study Areas (WSAs) lie within the area, including Owlshead Mountains, Saddle Peak Hills, Avawatz Mountains, South Avawatz Mountains, Soda Mountains, Kingston Mountains, and Hollow Hills.

Private lands are scattered throughout the Silurian Valley portion of the study area. They mostly coincide with the mining claims that occur in the area. Very few actual dwellings occur within the study area. Private lands encompass approximately 8,038 acres (1.7 percent) of the land proposed for acquisition.

State lands generally appear as a checkerboard pattern throughout the Silurian Valley. These lands comprise approximately 15,374 acres (3.2 percent) of the study area. The California State University System has a research facility located at Sheep Creek Springs managed by the Desert Studies Consortium.

Public lands withdrawn for military purposes comprise approximately 148,870 acres (31.1 percent) of the proposed land acquisition area. All of these lands are located within the Mojave B Range of the U.S. Naval Weapons Center at China Lake.

Four BLM Multiple Use Classes (MUC) of the Desert Plan (1980, as amended) are present in the study area. Figure 3.2-2 shows the locations of the MUC designations within the study area. MUC "C" (controlled use) generally corresponds to sensitive lands such as WSA's and ACEC's. Even though these areas are classified as controlled, they still have potential uses including limited grazing, mineral exploration and development, and limited recreation. Lands designated as MUC "C" comprise approximately 979 acres (0.2 percent) of the study area. MUC "L" (limited use) lands are managed to provide for generally lower intensity uses, such as grazing, limited mineral exploration and development, limited recreation, and designated motorized vehicle access. Lands designated as MUC "L", comprise approximately 133,120 acres (27.8 percent) of the study area. MUC "M" (moderate use) is based upon a controlled balance between higher intensity use and protection of public lands. A wide variety of present uses are provided for in this class, including grazing, agriculture, mineral exploration and development, motorized vehicle access, and recreation. Lands with a designation of MUC "M" occupy approximately 170,951 acres (35.7 percent) of the study area. Intensive use areas (MUC "I") are those areas where extensive OHV use, agriculture, grazing, recreation, and mining and mineral exploration take place. Approximately 1,248 acres (0.3 percent) of the study area has been designated as MUC "I". Areas designated as closed areas correspond to the military lands within the China Lake Naval Weapons Center Mojave B Range and occupy approximately 148,870 acres (31.1 percent) of the study area.

- The Cronese Basin Area of Critical Environmental Concern (ACEC) borders the southeastern corner of the study area.

- The Salt Creek and Denning Springs ACECs are located within the northern boundary of the study area.

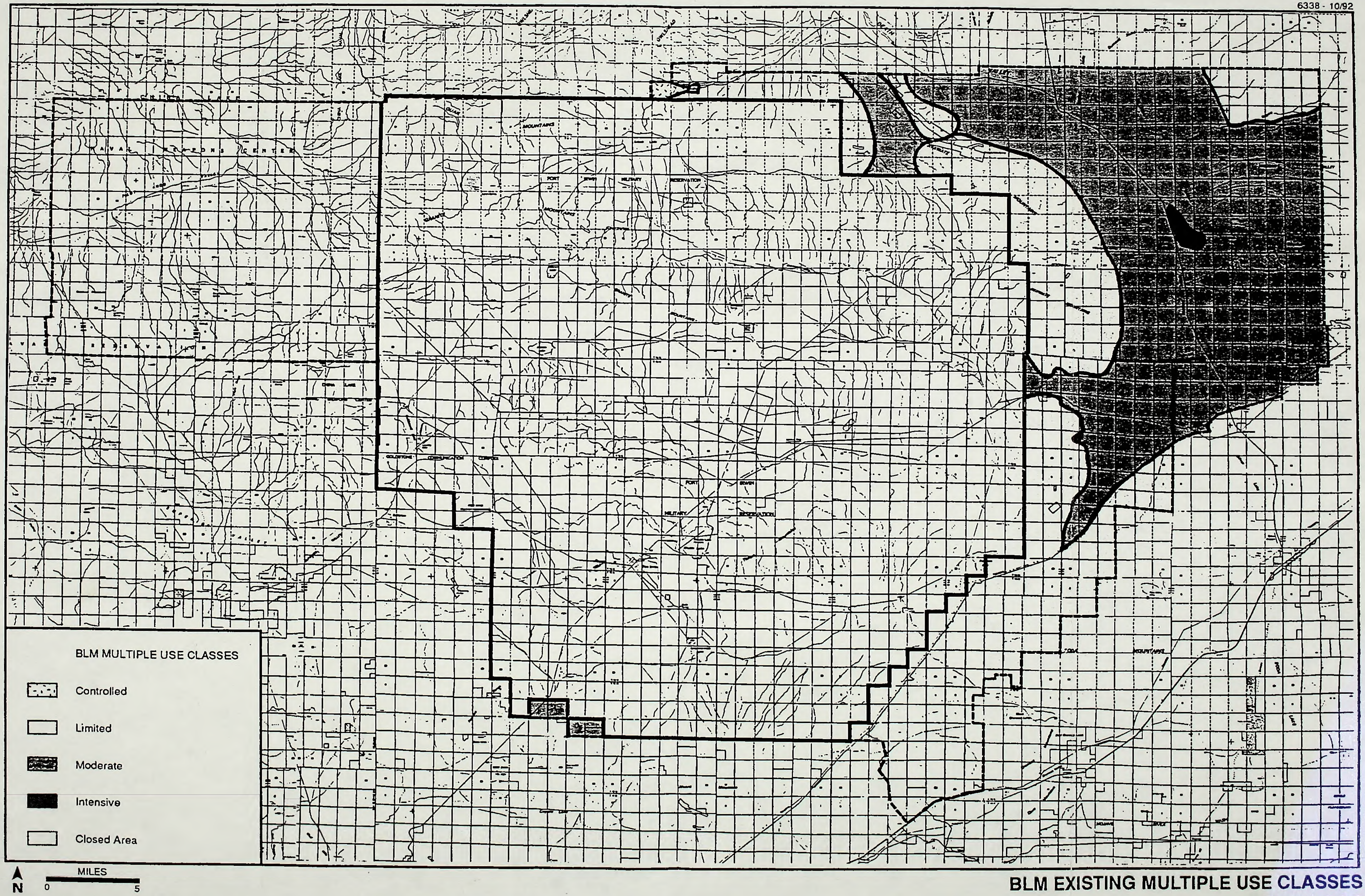
- All or portions of seven Wilderness Study Areas (WSAs) lie within the area, including Cronese Mountains, Saddle Peak Hills, Avawatz Mountains, Owlshead Mountains, Soda Mountains, Kingston Mountains, and Hollow Hills.

Private lands are scattered throughout the Silurian Valley portion of the study area. They closely correspond with the mining claims that occur in the area. Very few private holdings occur within the study area. Private lands encompass approximately 8,000 acres (1.7 percent) of the land proposed for acquisition.

State lands generally appear in a checkerboard pattern throughout the Silurian Valley. These lands comprise approximately 15,477 acres (3.3 percent) of the study area. The California State University System has a research facility located at Soda Springs (Zzyzx) managed by the Desert Studies Consortium.

Public lands withdrawn for military purposes comprise approximately 168,820 acres (35.7 percent) of the proposed land acquisition area. All of these lands are located within the Mojave B Range of the U.S. Naval Weapons Center at China Lake.

Four BLM Multiple-Use Classes (MUCs) in the Desert Plan (1980), as amended, are present in the study area. Figure 3.3-1 shows the boundaries of the MUC designations within the study area. MUC "C" (controlled use) generally corresponds to sensitive lands such as WSAs and ACECs. Even though these lands are classified as controlled, they still have activities such as limited grazing, mineral extraction and development, and limited recreation. Lands designated as MUC "C" comprise approximately 800 acres (0.2 percent) of the study area. MUC "L" (limited use) lands are managed to provide for generally lower intensity uses, such as grazing, limited mineral exploration and development, limited recreation, and designated motorized vehicle access. Lands designated as MUC "L" comprise approximately 135,717 acres (28.7 percent) of the study area. MUC "M" (moderate use) is based upon a controlled balance between higher intensity use and protection of public lands. A wide variety of present uses are provided for in this class, including grazing, agriculture, mineral extraction and development, recreation vehicle access, and recreation. Lands with a designation of MUC "M" occupy approximately 170,791 acres (36.1 percent) of the study area. Intensive use areas (MUC "I") are those areas where intensive ORV use, agriculture, grazing, recreation, and mining and mineral exploration take place. Approximately 1,288 acres (0.3 percent) of the study area has been designated as MUC "I". Areas designated as closed areas correspond to the military lands within the China Lake Naval Weapons Center Mojave B Range and occupy approximately 168,820 acres (35.7 percent) of the study area.



BLM EXISTING MULTIPLE USE CLASSES
Figure 3.2-2

The BLM has developed a system of categorizing desert tortoise habitat on public lands based on the following; importance of the habitat in maintaining viable populations, resolvability of conflicts, tortoise density, manageability, and population status. The application of these interim habitat management categories is specific to management of public lands (Spang et al., 1988).

Because these categories were determined to be Interim Habitat Management Categories they were defined as subject to further information gathering. Figure 3.2-3 shows the status of the current BLM Interim Habitat Management Categories in the California Desert Conservation Area. Figure 3.2-4 shows the current status of these categories in the study area. Approximately 256 acres (0.4 square miles) of Category 1 lands and 31,705.6 acres (49.54 square miles) of Category 2 lands lie within the study area boundaries. The remainder of the study area does not have an Interim Habitat Management Category designation. Approximately 0.03 percent of the Category 1 lands and approximately 8.6 percent of the Category 2 lands within the Western Mojave occur within the Silurian Valley/Mojave B Range acquisition area.

Table 3.2-1

LAND OWNERSHIP WITHIN THE LAND ACQUISITION ALTERNATIVES

Proposed Acquisition Area	Federal Public Land[1] acres (mi^2)	State Land acres (mi^2)	Private acres (mi^2)	Total acres (mi^2)
Silurian Valley/ Mojave B Range	455,168 (711.2)	15,374 (24.0)	8,038 (12.6)	478,580 (747.8)

[1] **Includes 148,870 acres (232.6 square miles) withdrawn by the Department of Defense for military purposes and 306,298 acres (478.6 square miles) directly managed by the Bureau of Land Management.**

3.3 VEGETATION

Ten different plant community types were mapped (Figure 3.3-1) and classified in accordance with the California Natural Diversity Data Base (CNDDB) natural community system and are presented in Table 3.3-1. Lands proposed to be shared on the U.S. Naval Weapons Center are not included here. These lands were previously described in the Navy's Biological Assessment for Section 7 negotiation on their ongoing mission. The community descriptions which follow are adapted from reports produced by the FWS (1988) and Bagley (1989).

- **Mojave Creosote Bush Scrub.** The Mojave creosote bush scrub community is characterized by the presence of scattered creosote bush (*Larrea tridentata*), the dominant shrub. This community is usually found on well-drained soils, often on bajadas and low hills, and is not found in highly salty or alkaline soils. The steepest and rockiest slopes,

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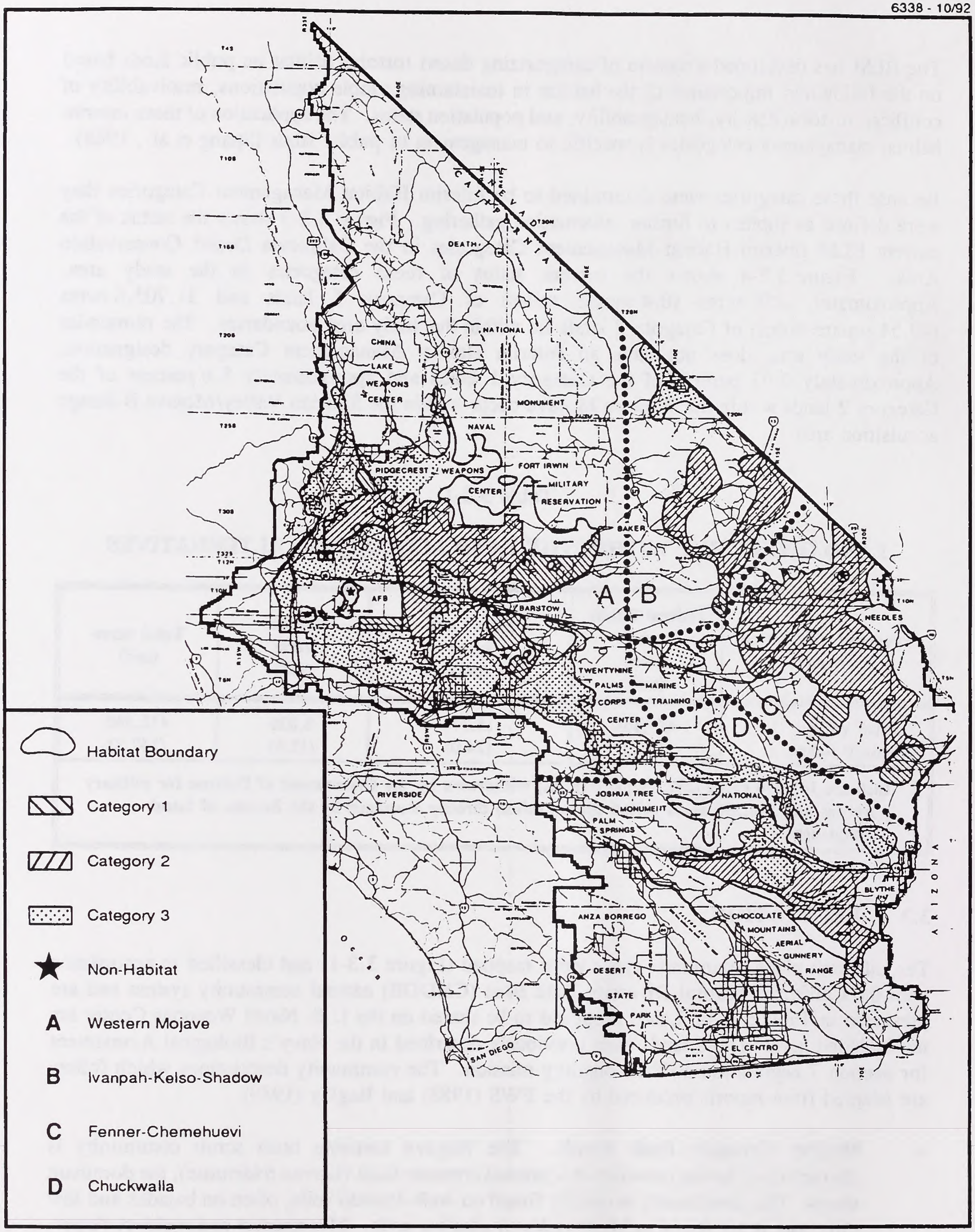

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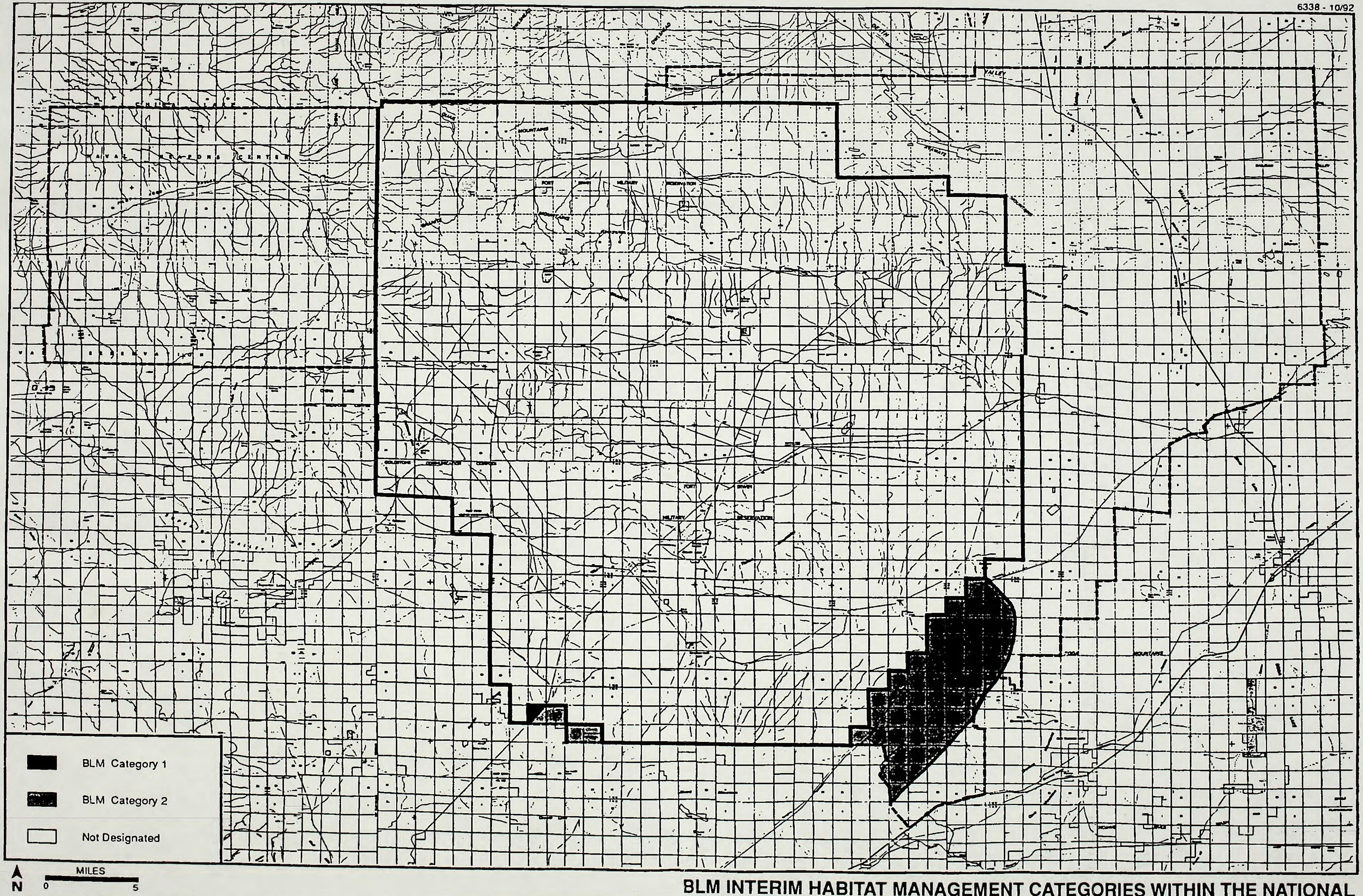
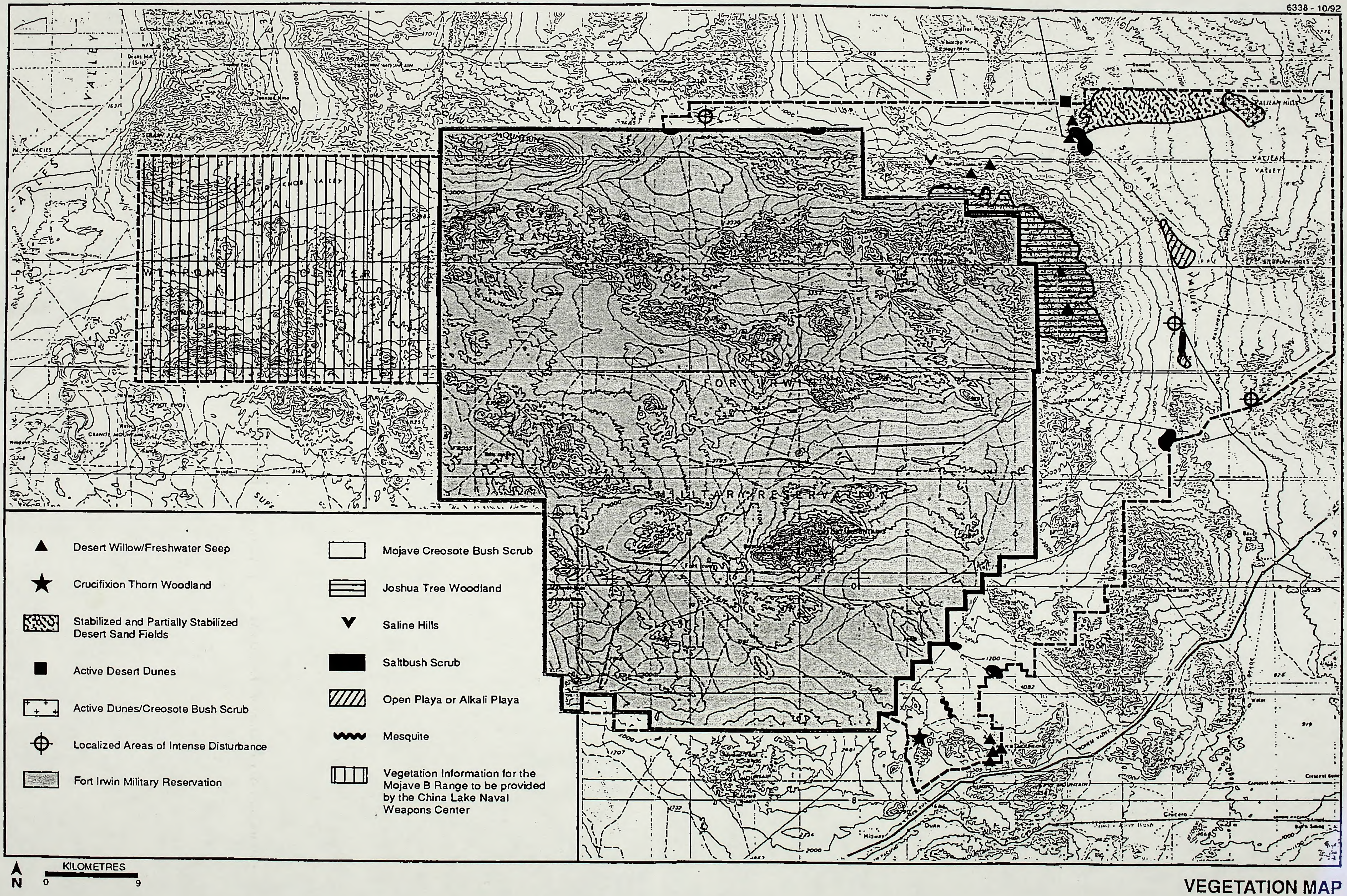
BLM INTERIM HABITAT MANAGEMENT CATEGORIES

Figure 3.2-3



SOURCE: BLM 1980 CDCA DATA

BLM INTERIM HABITAT MANAGEMENT CATEGORIES WITHIN THE NATIONAL TRAINING CENTER PROPOSED LAND EXPANSION STUDY AREA
Figure 3.2-4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VALLEY
NAVAL
WEAPONS CENTER
GRANITE MOUNTAINS
FORT IRWIN
MILITARY RESERVATION
SILURIAN VALLEY
VALJEAN VALLEY
VALJEAN HILLS
▲ Desert Willow/Freshwater Seep
★ Crucifixion Thorn Woodland
Stabilized and Partially Stabilized Desert Sand Fields
■ Active Desert Dunes
Active Dunes/Creosote Bush Scrub
⊕ Localized Areas of Intense Disturbance
Fort Irwin Military Reservation
Mojave Creosote Bush Scrub
Joshua Tree Woodland
▼ Saline Hills
Saltbush Scrub
▨ Open Playa or Alkali Playa
Mesquite
Vegetation Information for the Mojave B Range to be provided by the China Lake Naval Weapons Center
N
KILOMETRES
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VEGETATION MAP
Figure 3.3-1

washes, saltbush flats, and dry lake beds are essentially the only areas without significant concentrations of this habitat. This community is the most common and widespread type found within the study area comprising 297,398 acres or 90.2 percent (89.5 percent within the Silurian Valley and 0.7 percent in the southern section). The majority of the study area consists of Mojave creosote bush scrub and is located south, southeast and north of the Soda Mountains, the Silurian Valley and Hills, Valjean Valley and north and northwest of the Avawatz Mountains. An additional area is found in the vicinity of Fort Irwin Road and Paradise Mountains.

Table 3.3-1

VEGETATION COMMUNITY TYPES FOUND IN THE STUDY AREA

Community	Acreage
Mojave Creosote Bush Scrub	297,398.8 (90.2%)
Joshua Tree Woodland	17,144.9 (5.2%)
Saltbush Scrub	1,516.7 (0.46%)
Open Playa or Alkali Playa	1,582.6 (0.48%)
Mojave Wash Scrub/Freshwater Seep	824.3 (0.25%)
Crucifixion Thorn Woodland	98.9 (0.03%)
Saline Hills	263.8 (0.08%)
Stabilized/Partially Stabilized Desert Sand Fields	8,803.3 (2.67%)
Active Desert Dunes/Dunes-Creosote Bush Scrub	1,582.6 (0.48%)
Localized Areas of Intense Disturbance	395.7 (0.12%)

- **Joshua Tree Woodland.** Joshua tree woodland is recognized by the visual dominance of Joshua trees, an extremely conspicuous species that grows to 12 meters in height. The woodland consists of a low, open, scrubby understory of various shrubs and perennial herbs with a Joshua tree overstory. The understory shrubs typically consist of Mojave creosote bush scrub, Mojave mixed woody scrub, blackbush scrub, or a sagebrush scrub community. This community usually occurs at elevations of 3,000 to 5,500 feet, in sandy, loamy, or fine gravelly soils, usually on fairly gentle bajadas slopes. Within the study area, Joshua tree woodland occupies approximately 17,144.9 acres (approximately 5.2 percent) and occurs at elevations above 3,000 feet in the Avawatz Mountains.

- **Saltbush Scrub.** Desert saltbush scrub is characterized by the dominance of one or more species of saltbush which form an open, low shrub community dominated by gray colored shrubs about 0.3 to 1 meter tall, with few herbaceous plants. It is a widespread and variable community type within the study area and comprises 1,516.7 acres (approximately 0.46 percent) of the study area. Typically, one dominant species of saltbush is found in association with a few additional species (possibly including other species of saltbush). This community typically occurs on the lower bajadas slopes, plains, and around playas. It exists in localized areas in the vicinity of Highway 127 at Salt Creek and east and southeast of the Avawatz Mountains as well as southwest of the Soda Mountains.

- **Open Playa or Alkali Playa.** Open playas occur at the lowest elevations in closed basins where runoff temporarily collects after heavy rains. The waters that settle on the playa bring fine silts and clays which they deposit along with salts and minerals. Thus, they are poorly drained and are usually saline or highly alkaline. Playas are nearly flat and generally devoid of vegetation. Some playas support a patchy growth of a few annual species [often saltbush or nuttall monolepis (*Monolepis nuttaliliana*)], or occasional clumps of low shrubby vegetation (usually saltbush or inkweed) that occur on mounds of soil elevated a few centimeters above the playa level. Playas occupy approximately 1,582.6 acres (0.48 percent) of the study area, and occur in 2 areas -- Silurian Lake and west of Highway 127 in the vicinity of the Avawatz Mountains.

- **Mojave Wash Scrub/Freshwater Seep.** Mojave wash scrub occupies approximately 824.3 acres (approximately 0.25 percent) of the study area, and supports desert willow (*Chilopsis linearis*) and mesquite (*Prosopis* sp.) because of these species' importance to wildlife and their infrequent occurrence in this portion of the Mojave Desert. This community is a low, shrubby community with abundant open areas between the shrubs and occurs in sandy soils throughout the Mojave Desert in washes, arroyos, and canyons (Holland, 1986). These areas experience periodic flooding from the intermittent streams that flow through and maintain the open character of this community. The freshwater seep communities are characterized by a dense growth of perennial herbs, especially sedges and grasses, and are found on permanently moist or wet soils around freshwater seeps. Localized areas of these communities are found in the vicinity of the Cronese Mountains and the Avawatz Mountains.

- **Crucifixion Thorn Woodland.** Crucifixion thorn woodland is a desert woodland characterized by the dominance (at least visually) of crucifixion thorn (*Castela emoryi*), a small tree. It occurs on fine alluvial soils below 2,000 feet in only a few scattered localities in the Colorado and Mojave Deserts of California. One small area (approximately 98.9 acres or approximately 0.03 percent) of crucifixion thorn woodland occurs within the study area and is located north of Highway 15, west of the Cronese Mountains.

- **Saline Hills.** This feature occurs in a small, localized area on the north side of the Avawatz Mountains, west of Cottonwood Spring. These hills are covered with a salt crust and are virtually unvegetated. This feature is approximately 263.8 acres in size, comprising less than 0.1 percent of the study area. The area is located west of Silver Lake and in the northwest portion of the Avawatz Mountain near the Creek Mine.

- **Stabilized and Partially Stabilized Desert Sand Fields.** This unique community occurs along the northeast boundary of the study area, west of the Valjean Hills. Sand verbena (*Abronia* spp.) is common. Perennial shrubs are virtually absent but diversity of herbaceous species can be high. This type of flora reflects a low capacity of the soil to retain moisture, a feature which favors annual species that flower and set seed within a short period of time in the spring. Approximately 8,803.3 acres (2.7 percent) of the study area is occupied by this community. It is found in the northern part of Silurian Valley/ Valjean Valley area and extends from Spring Mountain to the Valjean Hills.

- **Active Desert Dunes and Dunes/Creosote Bush Scrub.** Dune systems are represented by the Ripple Dunes (also called the Little Dumont Dunes) at the northern border of the study area and in the Valjean Hills in the northeast corner of the study area. In the Valjean Hills, dunes are intermixed with volcanic outcrops that support creosote bush scrub vegetation. The species such as sandpaper plant (*Petalonyx thurberi* ssp. *thurberi*) are frequent. Dunes occupy approximately 1,582.6 acres (0.5 percent) of the study area.

- **Localized Areas of Intense Disturbance.** These areas are largely unvegetated except for non-native species such as saltcedar (*Tamarix* sp.). They do not include roads, but represent visible scars on the landscape that have little resource value. Most of these areas are associated with mining activity or roadside construction activities along Highway 127. Collectively these areas occupy less than 395.7 acres (approximately 0.12 percent) of the study area. These occur in isolated areas south of Owlshead Mountains, west of Highway 127 in the vicinity of the eastern side of the Avawatz Mountains, and east of Silver Lake.

3.4 DESERT TORTOISE BIOLOGY

The desert tortoise is a herbivorous reptile found in portions of the California, Arizona, Nevada, and Utah deserts. It also occurs in Sonora and Sinaloa, Mexico. It is the only species of native tortoise occurring within its range. Others members of the Genus include the Texas Tortoise of Southern Texas, the Bolson Tortoise of North-Central Mexico, and the Gopher Tortoise of the South-East U.S.

In California, the desert tortoise is found in a wide range of elevations, with the exception of extremely low desert and higher montane habitats. Its range roughly approximates the distribution the Creosote bush (*Larrea tridentada*) throughout the southwest deserts.

Desert tortoises spend a large portion of the year underground avoiding extreme temperatures and, for younger tortoises, a variety of predators, such as coyotes, foxes, and raptors. They construct and maintain single opening burrows, with an individual tortoise using several burrows within its home range. They will also utilize natural overhangs in wash walls when soil conditions are not favorable for burrow construction.

Generally, tortoises are active during the spring, early summer, and autumn when annual plants are most common and daily temperatures are tolerable. Additional activity occasionally occurs during warm weather in winter months and after summer rain storms. In the Western Mojave Desert, tortoises tend to concentrate their activity period largely in the spring and early summer during the spring bloom. They display a more bimodal yearly activity pattern in the eastern portions of their range, where winter and summer rainfall pattern normally results in fresh forage being available in both the spring and fall.

The FWS determined that the desert tortoise warranted listing in response to increasing habitat disturbance and increased mortality over portions of its range. The cause of this increased mortality was initially thought to be due to the spread of Upper Respiratory Tract Disease (URTD), formerly referred to as Upper Respiratory Disease Syndrome (URDS). Subsequent investigations of the disease have led to speculation that the disease may be, at least partially stress-related. Increased stress may be a result of the desert-wide drought, which has occurred over the past 5 years, and has resulted in lower-than-normal production of annual plant biomass. Only one case of URTD has been confirmed in a desert tortoise in the study area. This animal was collected from Fort Irwin Road (Christianson, personal communication). A number of diseased tortoises have been found south of the study area. There has also been documentation of high mortality rates to the west.

A small section of the study area has been subjected to limited livestock grazing. The potential effects of livestock grazing on tortoise food resources and survivorship has become a growing concern for desert tortoise biologists. Cattle grazing does occur on the east side of the proposed acquisition area (Cronese, perennial/ephemeral cattle allotment).

3.5 RELATED STUDIES

3.5.1 Tortoise Density Surveys

In 1988, approximately 330 square miles of the study area were surveyed for desert tortoises by the FWS. Following this study, another tortoise density survey was conducted over an additional 386 square miles of lands that were either proposed for use by the NTC or were considered an isolation area (Chambers Group, 1990a). Figure 3.5-1 shows the data compiled from these and other tortoise surveys conducted in the vicinity of, and including the NTC. The purpose of these surveys was to determine the distribution and density of the desert tortoises within the study area and in areas that could be isolated by proposed activities. Identical methodology was used in both of these surveys and consisted of estimating distribution and density using the belt-transect method developed by Berry and Nicholson (1984), though in the 1990 survey a higher density of survey transects were completed (approximately 1 transect/square mile, compared to 1 transect/3-4 square miles in the 1988 survey). The transect technique is based on the assumption that the frequency of tortoise sign (scat and burrows) observed along a transect is related to the density of tortoises in the vicinity of the transect. Ninety transects were conducted during the 1988 survey and 468 transects were conducted during the 1990 survey.

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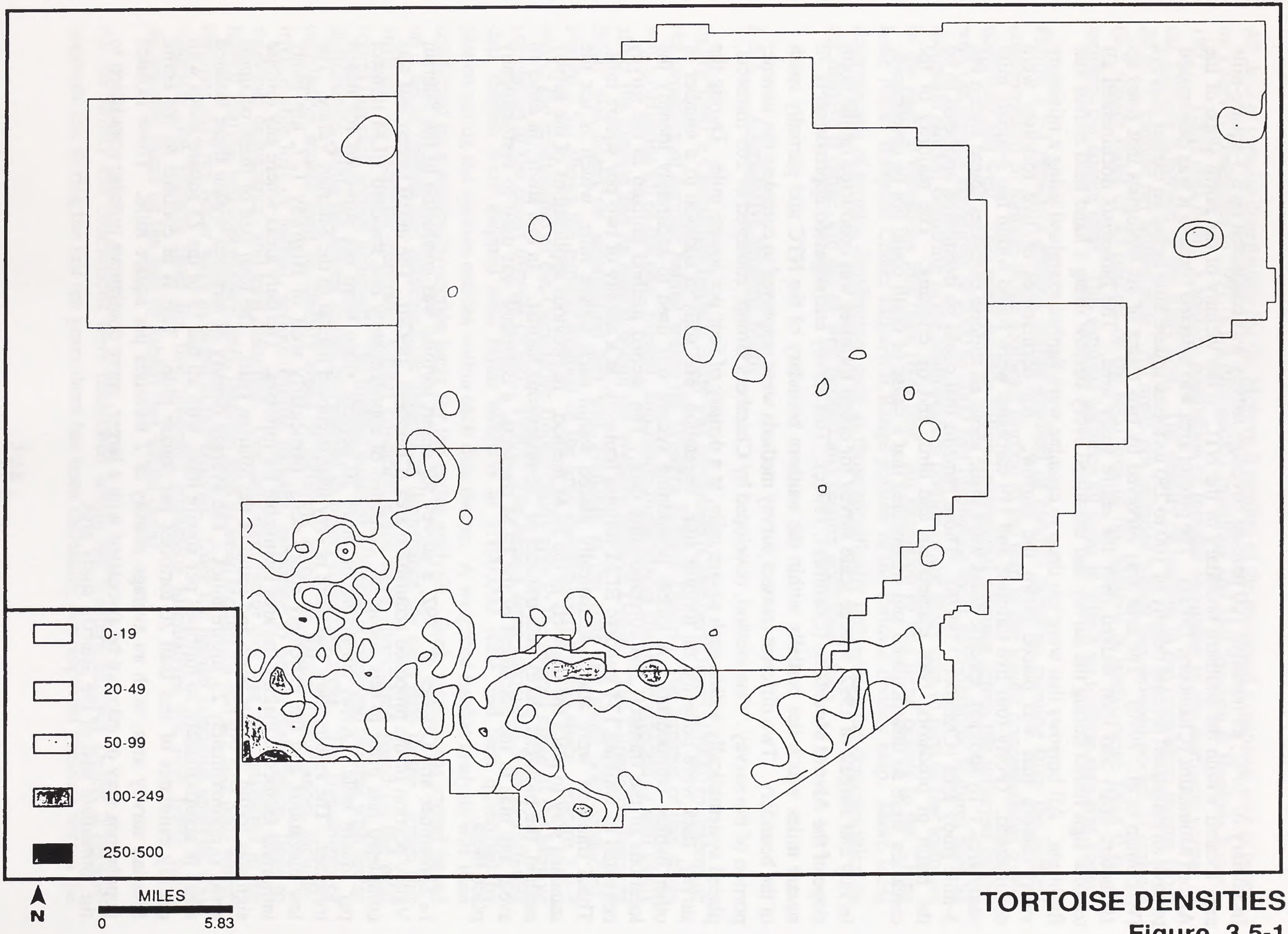

TORTOISE DENSITIES
Figure 3.5-1

In January of 1992, an intensive 100 percent coverage survey was conducted on a 3-square-mile area located within the southern boundary of the NTC in the vicinity of the north slope of the Alvord Mountains (Chambers, 1992a). The project area was selected because it was determined to have an estimated tortoise density of 100 to 250 tortoises/square mile based on earlier surveys (Woodman et al., 1990). The area was surveyed by two teams of six biologists that lined up 10 meters apart and then walked over the entire study area. The biologists documented all tortoise sign found during the survey and examined every burrow using a hand held mirror and flashlight. All burrows that were too deep to examine were further examined using a miniature video camera that was placed down the burrow. All occurrences of live tortoises were documented. (Forty-four live tortoises and 119 carcasses were found within the 3-square mile study area.) In addition, specific notes were made about all tortoise carcasses found within the 3-mile study area (Chambers, 1992b). Those remains that could be interpreted appeared to be the result of predators, both mammalian and bird, and by crushing. The majority of the carcasses were so disarticulated and fragmented that a cause of death could not be determined.

In July and August of 1992, a large scale survey for desert tortoises was conducted on the north slope of the Alvord Mountains (Chambers, 1992c). This survey encompassed approximately 70 square miles which lies partially within the southern boundary of the NTC and partially south of the boundary. Two different transect survey methods were employed to complete the summer portion of the survey. One method, developed by Chambers Group, consisted of 269 transects, placed systematically within each square mile, at a density of four per square mile. During the survey, data were collected on tortoise sign, vegetation, and soils in addition to a number of other habitat components. A global positioning system was used to accurately identify the locations of the transects and corresponding data. The second method utilized in the survey consisted of walking 134 standard BLM tortoise transects, at a density of two per square mile. These transects were also systematically placed within each square mile, which is not the standard way to place the transects in the BLM method. In previous applications of the survey method, the biologist places each transect in "homogeneous habitat." In this study, in order to avoid any bias in the placement of the BLM transects, a computer was used to systematically place them.

In September and October of 1992, a survey for desert tortoise was conducted in the Silurian Valley portion of the proposed acquisition area (Chambers, 1992d). The initial sweep that was completed just prior to this document, consisted of approximately one standard BLM transect per square mile. Areas consisting of more 20 percent slope were not surveyed for desert tortoises. The results show that there is very little occupied habitat in the Silurian Valley. The low elevations and the extremely rocky soils, particularly west of Highway 127, are likely important factors in making the area unsuitable for tortoises. The only areas where any tortoise sign was found was just north and south of the Silurian Hills. The total size of these occupied areas is approximately 23 square miles. The average density of tortoises within these isolated areas is approximately 26 tortoises per square mile, with all but 13 of the 23 square miles with density estimates of less than 20 tortoises per square mile. This is in contrast to the entire Silurian survey area, with an average density of 2 tortoises per square mile. These isolated populations may or may not be associated with a larger, more contiguous tortoise population to the immediate east of the Silurian study area.

All data of tortoise distribution for the Mojave B portion of the proposed expansion area is based on a survey conducted in 1991 (Kiva Biological Consulting and McClenahen & Hopkins Assoc., 1991). These data depict a solitary population of tortoise occurring in the northeast corner of the Mojave B portion of the study area. The density of tortoise in the population ranges from 20 to 50 tortoise per square mile. All areas not included within this isolated pocket of tortoise (8.2 square miles or 43 percent of the total area of the Mojave B lands) range from 0 to 20 tortoises per square mile. This estimate includes all areas in which no tortoise sign was found.

Figure 3.5-1 depicts a general spatial gradient of tortoise densities running from the highest concentrations of tortoise in the southeast portion of the map to the lowest concentrations to the northwest and west. This trend roughly follows elevational changes across the surveyed lands, with the highest elevations of 2000 to 3000 feet (excluding local physiographic features such as mountain ranges) occurring in the southwestern portion of the study area to zero or few tortoises in the east, at elevations less than 1000 feet. An exception to this trend occurs in the China Lake Naval Weapons Center Mojave B Range portion of the tortoise density map. More local determinants of tortoise distribution, such as those specifically influencing the demographics on the Mojave B range, are not as well defined and require additional study.

3.5.2 Cumulative Impacts Study

In late 1990, a Cumulative Impacts Study was conducted (Chambers Group, 1990b) to determine the condition of tortoise habitat within the Western Mojave Desert. The purpose of this study was to examine all of the past, present, and future disturbances that have affected or will likely affect the tortoise and its habitat within the Western Mojave Desert. The Cumulative Impacts Study was based on information that was available at the time the study was conducted. Figure 3.5-2 shows the general location of the area encompassed by this study. Figure 3.5-3 shows the relationship of the Cumulative Impact Study area to the overall range of the Mojave population of the desert tortoise (NERC, 1990). The impact areas associated with 21 different data themes were mapped onto mylar overlays at 1:100,000 scale and then quantified by planimetering the various entities within each data theme. A weighted habitat analysis was then conducted on a section-by-section basis for the entire analysis. Each section was scored based on a set of criteria that addressed the amount of disturbance for each data theme. From this analysis, 11 computer generated habitat condition maps were constructed based on the total scores that each section achieved. The highest numbers achieved correspond to areas with fewer disturbances while the lowest scores correspond to highly disturbed areas. The five ranges of cumulative scores used to identify areas of differing levels of habitat disturbances include: irretrievable loss of habitat, serious habitat damage, moderate to heavy disturbance, light to moderate disturbance, and least disturbed. One important factor that was not considered in the habitat analysis was topography; thus, features such as steep mountains and dry lake beds where tortoises may not occur were included in the analysis. Once the habitat condition analysis was complete, the impacts from the five proposed expansion alternatives for Fort Irwin were determined based on the loss of habitat that would occur.

As the results and conclusions were calculated within the Western Mojave Desert it became apparent that during the last ten years there has been increasing development pressure within the

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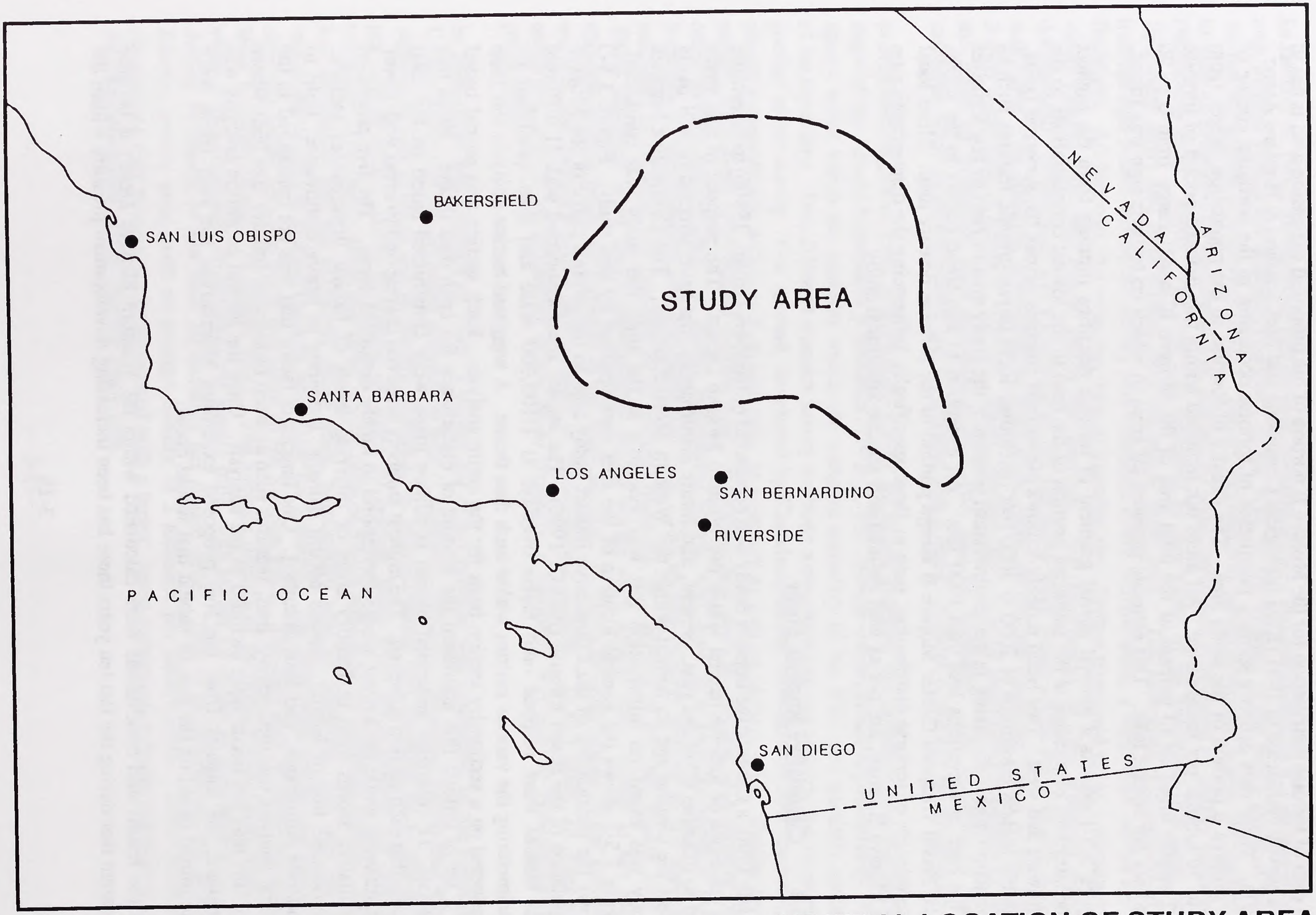

GENERAL LOCATION OF STUDY AREA
Figure 3.5-2

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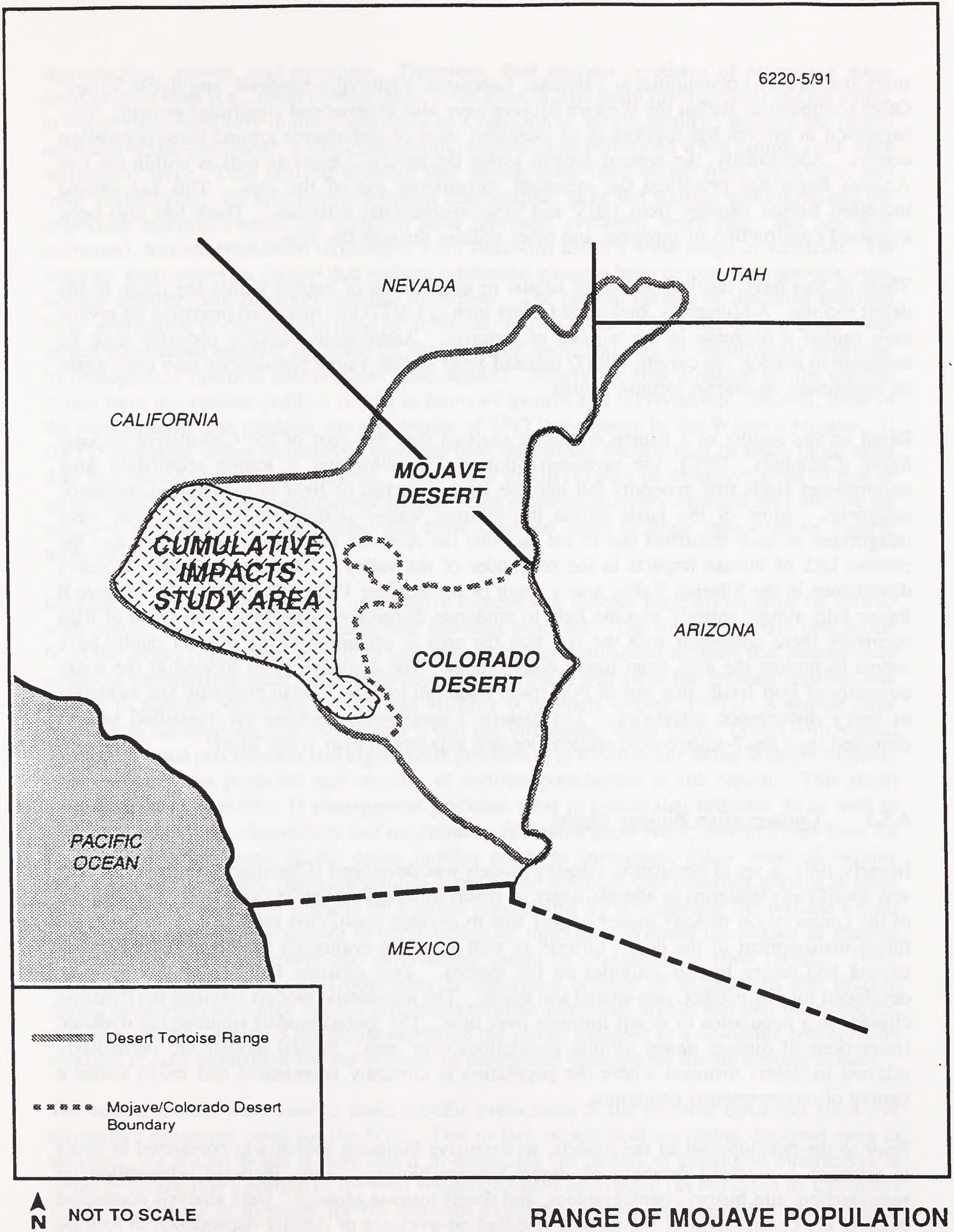

RANGE OF MOJAVE POPULATION OF DESERT TORTOISE

Figure 3.5-3

study area in such communities as Palmdale, Lancaster, Victorville-Hesperia, and Apple Valley. Other communities within the Western Mojave have also experienced significant growth. This expansion in growth has resulted in an increased level of disturbance around these population centers. Additionally, the general growth within the Mojave Desert as well as within the Los Angeles Basin has promoted the increased recreational use of the area. This has caused increased habitat damage from OHV and other recreational activities. There has also been increased construction of pipelines and other utilities through the area.

These factors have resulted in loss of habitat or degradation of habitat within the range of the desert tortoise. Additionally, biological factors such as URTD and increased predation by ravens have caused a decrease in the number of tortoises. Additionally, healthy tortoises must be available to restock the current URTD infested areas so that viable populations may once again be established on known tortoise habitat.

Based on the results of a habitat condition analysis that was part of the Cumulative Impacts Study (Chambers, 1990), the proposed Silurian Valley/Mojave B Range acquisition area encompasses lands that generally fall into the least disturbed or light to moderate disturbance categories. Most of the lands within the Silurian Valley portion of the study area were categorized as least disturbed due to the fact that the Avawatz Mountains occur there and the relative lack of human impacts in the remainder of the valley. The only moderate to heavy disturbance in the Silurian Valley was a result of the Boulder Utility Corridor. The Mojave B Range falls almost entirely into the light to moderate disturbance category. The types of uses occurring there combined with the fact that the area is off limits to the general public have served to protect the area from heavy disturbances. The 4 square miles located at the south boundary of Fort Irwin, just east of Fort Irwin Road fall into the light to moderate and moderate to heavy disturbance categories. The eastern 2-square-mile sections are classified as less disturbed than the 2-square-mile sections located adjacent to Fort Irwin Road.

3.5.3 Conservation Biology Model

In early 1991, a set of population viability models was developed (Chambers Group, 1991) that was specifically designed to address issues of desert tortoise population dynamics. The purpose of the conservation biology model project was to develop population models to help guide the future management of the desert tortoise as well as aid in evaluating the potential impacts of current and future human activities on the species. Two separate families of models were developed for this project, non-spatial and spatial. The non-spatial models simulate the dynamic changes in a population of desert tortoises over time. The spatial models simulate the dynamic interactions of distinct desert tortoise populations over time. Spatial models are particularly relevant to desert tortoises where the population is currently fragmented and exists under a variety of environmental conditions.

Prior to the development of the models, an extensive literature search was conducted in order to establish a working database on desert tortoise biology. Data included information on reproduction, life history, demographics, and desert tortoise ecology. Data analysis conducted prior to the construction of the models revealed no evidence of density dependence in tortoise reproduction, growth, and mortality. Therefore, data analysis consisted of estimating mean demographic rates (i.e., mean reproduction, mean growth, and mean survivorship) and the extent to which these rates vary in time, space and as a function of habitat quality. Because the model approach is size-structured, a size-class specific analysis was performed when sample sizes were sufficiently large. Data analysis revealed that demographic rates varied from site-to-site, and from year-to-year. By substituting different demographic rates and starting conditions into the projection matrices (where the different rates represent averages, worst-case, and best-case estimates), tortoise population trajectories were simulated under a wide range of scenarios. On average, most scenarios suggest that without substantial changes from current demographic rates tortoise numbers will certainly continue to decline. The general picture of declining tortoises from application of the models must be prefaced by two facts. First, the demographic rates reflect populations severely impacted by human disturbance, and may be significantly improved by management practices that mitigate these impacts. Ideally, an area managed for the tortoise would have the greatest positive results in terms of growth and survivorship. Second, most of the demographic data predates the appearance of URTD incidence in the Western Mojave. If URTD generates severe increases in mortality then the tortoise decline may be much more rapid than that predicted by the simulations. The results of URTD may be extensive areas of few or no tortoises in otherwise good tortoise habitat. One potential recovery measure may involve the selective reintroduction of tortoises into these depleted areas through relocation or captive breeding programs.

Because of limited baseline data, quantitative forecasts of tortoise populations must be viewed with caution until additional baseline data becomes available. The most important conclusion from the model is that both sensitivity analysis and model simulations indicate that management practices emphasizing older, reproductively active tortoises will yield the greatest benefits with respect to tortoise population growth and viability (Chambers Group, 1991). A second clear result from the application of the models is that the infrequent "good years" (years with normal or above normal precipitation and higher plant productivity) which occur in the Western Mojave, could improve the projected survivorship of tortoise populations in the region. This result highlights two key points: 1) management practices need to ensure that tortoises do as well as possible during those climatically and nutritionally favorable good years, and 2) a data base for a long-lived animal such as the desert tortoise needs to encompass many years of varying conditions. Additionally, there are tortoise experts who speculate that livestock grazing in areas of high rainfall may have impacts on tortoise populations by diminishing the tortoise's food supply, thus reducing the growth or survivorship of tortoises. Without the impact of grazing in these areas tortoise growth and survivorship could be exceptionally good (NERC, 1990; Chambers Group, 1991). This possibility is significant because of suggestions that grazing during these years with high rainfall suppresses tortoise nutritional uptake and thus physiological recovery (NERC, 1990). One recommendation the model suggests as a favorable conservation measure is land acquisition for the purpose of preserving manageable desert tortoise habitat.

The spatial models were used to make specific predictions of the possible outcomes from five alternative expansion plans for the NTC. Due to lack of any data regarding dispersal rates in tortoises, the spatial model is only useful in evaluating the effects of expansion alternatives in terms of subtracting a portion of the total Western Mojave population (as indicated by Chambers Group's censuses of tortoises for the different expansion areas), and removing areas which, because they differ in habitat quality, could represent different "investment" values with respect to future population growth. The actual percentage of tortoise population lost is dependent on the initial population size estimates. Because tortoise population estimates for the Western Mojave are based on limited data and habitat indices have not been well associated with demographics, one should not place great value on the exact numerical results produced by the spatial model. When available, better data on tortoise populations, habitat effects, and movement rates will enable the existing model to be used more extensively.

Despite the limitations of the models as accurate predictors of future desert tortoise demographics, they are important in providing general guidelines for conservation and management. They represent the best method that conservation biology has to date in the demographic analysis of a species. Also, results of the application of the models suggest that the periodic "good years" (years in which adequate rainfall has occurred and a high volume of annual plants are produced) are critical for the ongoing survival of the tortoise. Disturbance that reduces the frequency or magnitude of rare good years could seriously affect tortoises (Chambers Group, 1991). In general, the data analysis and modelling exercise described in the conservation biology model report are best used as strategic guidelines on where to concentrate management efforts and as signposts directing the need for future research and data collection.

Some of the specific needs for further research recommended in the Conservation Biology report results from exhaustive analysis of the "raw" data provided by the BLM, review of published information on tortoises, and the constraints of models for tortoise populations. The structure of future data collection should be arranged so that data is collected on a regular basis from a consistent set of populations, as opposed to on an irregular basis, from a set of populations that varies from year-to-year. This would easily be accomplished if funding for the data collection were more reliable. Better information on reproductive patterns in the Western Mojave is necessary. The role of URTD must be clarified. It's negative effect on older, reproductive animals is particularly important given the sensitivity of population growth to the survival rates of the larger size classes. Additionally, as the desert becomes more fragmented, patterns and rates of tortoise movement could play a major role in determining their response to URTD. This is especially important when running the spatial model simulations. Current home range data is inadequate for estimating rates of movement between fragmented populations, especially for a species which is known to have complex social and spatial behavior (Chambers Group, 1991).

3.5.4 Neonatal Tortoise Research Project

The California State University, Dominquez Hills (CSUDH) initiated a multifaceted investigation of neonatal tortoise biology. Dr. David Morafka responded to a request from Southern California Edison with a design for long-term investigation of nesting, neonates, and first year hatchlings. The NTC was contacted and has provided a secluded 1-square-mile area which was placed off-limits to training activities to support this research. The preliminary review of the scant existing literature indicated that neonatal tortoises were physiologically, ecologically, and behaviorally distinct from adults. To assess the special ecological needs of young tortoises, the research follows three major areas of investigation:

1. A search of existing literature on the biology of young desert tortoises.

2. The establishment of an experimental colony of nearly 100 donated hatchling tortoises at CSUDH.

3. The establishment of a predator proof enclosure around tortoise egg nests in a natural setting on the NTC.

A review of current literature and hypotheses about the distinctiveness of juveniles resulted in several formal professional presentations by Morafka and Joyner (Morafka, 1990). The studies in 1989 at the CSUDH campus facility were focused on approximately 60 captive tortoises which were raised and compared with 39 Arizona tortoises. Research was focused in several areas including: substrate choice trials, blood panels, dehydration analysis, nutritional studies, morphometrics and brumation ("hibernation"). In the spring of 1990, one square mile of NTC training land was designated a temporary off-limits area to study the desert tortoise. Twenty-three female tortoises were collected within a 16.8 km area and relocated to a predator proof enclosure. Fifty-seven eggs were laid and 93 percent of the eggs hatched. The high hatching success rate indicates that gravid females can be relocated without adversely affecting reproductive success. The neonates were observed exploring the enclosure, digging burrows, and feeding until they went into their burrows for the winter. Although much of the conclusions discussed in the first annual report (Morafka and Joyner, 1990) are tentative, the study is already regarded as an unqualified success.

Information obtained from Dr. Morafka's study illustrates that gravid females can be temporarily relocated without adversely affecting reproductive success and that neonatal tortoise can survive their first autumn within the enclosure (Morafka and Joyner, 1990). Both facts are valuable first steps in developing relocation techniques which may be vital to the recovery of the desert tortoise. Future information anticipated from this work will help understand the life history and needs of young tortoises. This additional information will be important to understanding and improving the survival of the desert tortoise.

3.6 URTD EFFECT (WESTERN MOJAVE VERSUS STUDY AREA)

Upper Respiratory Tract Disease (URTD) may be having a significant effect on the survival of desert tortoises in the Western Mojave Desert. For example, at the Desert Tortoise Natural Area (DTNA), it is believed that the 50 percent decline in tortoises numbers between 1979 and 1988 and the additional 25 percent decline between 1988 and 1989 was due, in part, to URTD. Declines at other BLM monitored study plots in the Western Mojave show similar declines (Berry, 1990). Evidence of the disease is locally prevalent throughout the Western Mojave. Signs of URTD range from 9 percent to 43 percent in surveys conducted in 1988 and 1989 (Avery and Berry, 1990). Other than one documented case of URTD near Fort Irwin Road in the Spring of 1991 (Bucknucker, 1992), populations on the NTC and the proposed expansion area appear to be free of the disease.

SECTION 4 - IMPACTS OF THE PROPOSED ACTION WITHOUT CONSERVATION MEASURES

This section describes the expected impact on desert tortoise populations within and adjacent to the proposed NTC study area that would occur if the action proceeds without the application of conservation measures. It's presented in this assessment strictly as a basis for comparison of impacts of the proposed action with and without compensation measures. The reader should note that the U.S. Army is fully committed to the application of conservation measures upon expansion of the NTC. Further, implementation of the action without acceptable conservation measures would likely be impracticable.

4.1 PROPOSED ACTION

During the EIS preparatory process, the NTC had determined that an expansion to the south would provide the best topography for required training maneuvers and the most flexibility for battle scenario development. Through development of the supporting studies, including the intensive tortoise surveys in the North Alvord Slope, and through consultation with the FWS, it became apparent that the impacts to the desert tortoise resulting from a southern expansion would be too great and thus the expansion to the south was eliminated. At the suggestion of the BLM and the FWS, the NTC explored the possibility of an eastward expansion into the Silurian Valley. The Silurian Valley, by itself, would not provide the area necessary for maneuver lands specified in the LURS study. Therefore the NTC has proposed including part of the central portion of the Mojave B Ranges as a joint use area between the Army and the Navy. To reduce the impacts of the proposed expansion on the desert tortoise, the Army is committing to a number of conservation measures.

The Silurian Valley/Mojave B Range Acquisition Area ensures that the Army can continue to accommodate the evolution of fighting doctrine and weapons systems in compliance with environmental laws and Army policies. Land acquisition fully complements existing maneuver areas, allowing area commanders to fully deploy their units as they use their weapons and targeting systems over doctrinally correct distances while subjecting maneuver and support units to a realistic and changing battle field environment. This land acquisition permits increased variety in training scenarios and enhances flexibility in using NTC's entire maneuver area. This flexibility is critical since most units rotate to the NTC every 12 to 18 months. To maintain the Army's qualitative training edge over potential adversaries, the NTC believes the maneuver space of the Silurian Valley/Mojave B Range acquisition best resolves the maneuver land shortage identified in the LURS study and validated by the GAO in 1990.

4.2 DIRECT IMPACTS

The impacts of maneuvers on desert tortoise populations have been demonstrated by surveys conducted on the existing NTC. Within maneuver areas, all tortoises and their habitat would eventually be lost where slopes are less than 20 percent. This direct impact would occur from actual crushing of tortoises and burrows as well as destruction of vegetation. Although all tortoises would not be lost immediately, habitat would become so degraded that few tortoises would remain. This loss of habitat and tortoises would be considered permanent considering the fragile nature of the desert landscape and the life history of tortoises. Figure 3.5-1 shows the areas of tortoises densities within the boundaries of the Silurian Valley/Mojave B Range acquisition area. The tortoise populations that would be impacted by the maneuvers include approximately 180 tortoises in the Mojave B Range, 240 tortoises near Dunn Road, and 650 tortoises in the Valjean and Silurian Valleys.

Implementation of the proposed acquisition would result in the transfer of approximately 306,298 acres of BLM lands to the Army that have been categorized according to the Multiple Use Class designations. Approximately 979 acres of controlled use, 133,120 acres of limited use, 170,951 acres of moderate use, and 1,248 acres of intensive use lands would no longer be under the jurisdiction of the BLM following the acquisition. As a result of the acquisition, the general public would no longer be permitted to engage in recreational, agricultural, OHV, or grazing activities. Limited mining, in the existing actively producing mines, would be able to continue. Additional mining activities and mineral exploration would be considered by the NTC on a project by project basis.

Implementation of the proposed project would result in the transfer, from the BLM to the Army, of desert tortoise habitat classified by the BLM as belonging to Categories 1 and 2. Implementation of the NTC acquisition would result in the withdrawal of these Category 1 and 2 lands from BLM jurisdiction. Approximately 0.4 square miles of Category 1 habitat and 49.54 square miles of Category 2 habitat would be encompassed by the boundaries of the Silurian Valley/Mojave B Range acquisition. Not all lands within the project area boundaries can be used for maneuvers but, a reduction in Category 1 or 2 habitat within the boundaries can be expected.

In the 1990 Cumulative Impacts Study on the Desert Tortoise (Chambers Group, 1990b), an analysis of the amount of disturbance to tortoise habitat within the Western Mojave Desert was conducted. Five categories of habitat condition were assigned based on the amount of observed disturbance. The following habitat condition categories were assigned irretrievable loss of habitat for the foreseeable future, serious habitat damage, moderate to heavy disturbance, light to moderate disturbance, and least disturbed. Based on the results of that analysis, the habitat within much of the Silurian Valley/Mojave B Range acquisition area appears to belong to the light to moderate and the least disturbed habitats. The Cumulative Impacts Study only encompassed the portion of the Western Mojave Desert lying west of Highway 127 so much of the proposed acquisition area was not considered in the cumulative impacts analysis that generated the habitat condition maps. Thus, a quantitative analysis of the number of acres of each category within the acquisition area was not done for the purposes of this report. The only noticeable disturbance in the acquisition area that falls into the moderate to heavy disturbance

Silurian Valley. Other than that, the condition of the habitat within the boundaries is relatively good.

4.3 INDIRECT IMPACTS

Implementation of the proposed NTC expansion may result in some indirect impacts to the surrounding area. Areas adjacent to the new boundaries might be subjected to increased noise, dust, emissions, and sand dune formation (from blown sand generated in the maneuver areas). The approximate area that would be affected by these impacts is expected to be limited to within 1 to 2 miles of the maneuver areas.

Military activities have the potential to generate refuse which could possibly result in the attraction of additional ravens to the acquisition area and adjacent tortoise habitats. Ravens have been known to prey on juvenile tortoises, but it is unknown if additional ravens would move into the new expansion area as a result of the presence of refuse. It is impossible to quantify what impact additional ravens may have on the tortoise population. Efforts to improve the NTC's on post solid waste landfill have resulted in a noticeable reduction in the raven population on post.

Without the application of conservation measures, such as barrier fences, there may be an impact on areas outside of the acquisition area boundaries from disoriented military vehicles. In the past, a few military vehicles have been reported outside of the NTC boundaries. Although the magnitude of this potential impact is small, it would be expected to be less where obvious natural or man-made boundaries occur. In addition, maneuver areas generally do not extend to the defined acquisition area boundaries (or the NTC's boundaries for that matter) because they are based on topographical and training scenario constraints. Therefore, impacts from disoriented military vehicles can be expected to be limited.

Indirect impacts in the form of isolation of some pockets of tortoises from larger, contiguous tortoise populations, may occur as a result of the proposed expansion. The areas to the west and southeast may be isolated. Tortoise population near the southeast corner are low density from which isolated tortoises should be translocated to areas with larger populations.

SECTION 5 - CONSERVATION MEASURES ANALYSIS AND COMMITMENTS

The conservation measures presented in this section were developed by Fort Irwin Army personnel in consultation with an interagency task force made up of federal (Army, Navy, BLM, and FWS) and state (CDFG) biologists. These measures were modified by NTC staff relative to meeting the NTC mission requirements. The following rationale/procedures were used to develop conservation measures in this biological assessment.

- The effects of the proposed NTC Land Acquisition alternative, both direct and indirect, were identified.
- Objectives, assumptions, and options were considered and specific measures were identified which could avoid direct impacts or otherwise lessen the adverse impacts.
- Measures were described in terms of effectiveness in reducing impacts and in terms of feasibility and cost of implementation.
- Quantities, benefits, and costs were estimated.
- Agency responsibilities were identified: implementation process, schedule/phasing; coordination requirements; monitoring and management requirements; compliance with environmental laws, regulations and policy; and potential legislative/congressional action.

The major conservation measure involved is the selection of the Silurian Valley/Mojave B Alternative instead of the Modified Coyote Alternative proposed in the October 1991 original Biological Assessment, since the majority of the Silurian Valley study area showed absolutely no sign of tortoise. Additionally, the NTC, in consultation with FWS, will develop conservation measures during the consultation process for protection of the areas that showed limited sign of desert tortoise. The following sections describe these measures.

5.1 PROPOSED CONSERVATION MEASURES

5.1.1 Tortoise Protection

Tortoise proof fencing is proposed to be placed in strategic areas to protect tortoise populations outside of NTC operation areas. As shown in Figure 5.1-1, the fencing is proposed to be installed on the west side of Dunn Road to protect the tortoise populations within the Coyote Basin. Additionally, fencing will be placed to protect the Cronese Basin Area of Critical Environment Concern (ACEC). Fencing will be tortoise proof where tortoise demographics and physical topography allows, as well as barrier fencing to enforce the off-limits boundaries at the ACEC.

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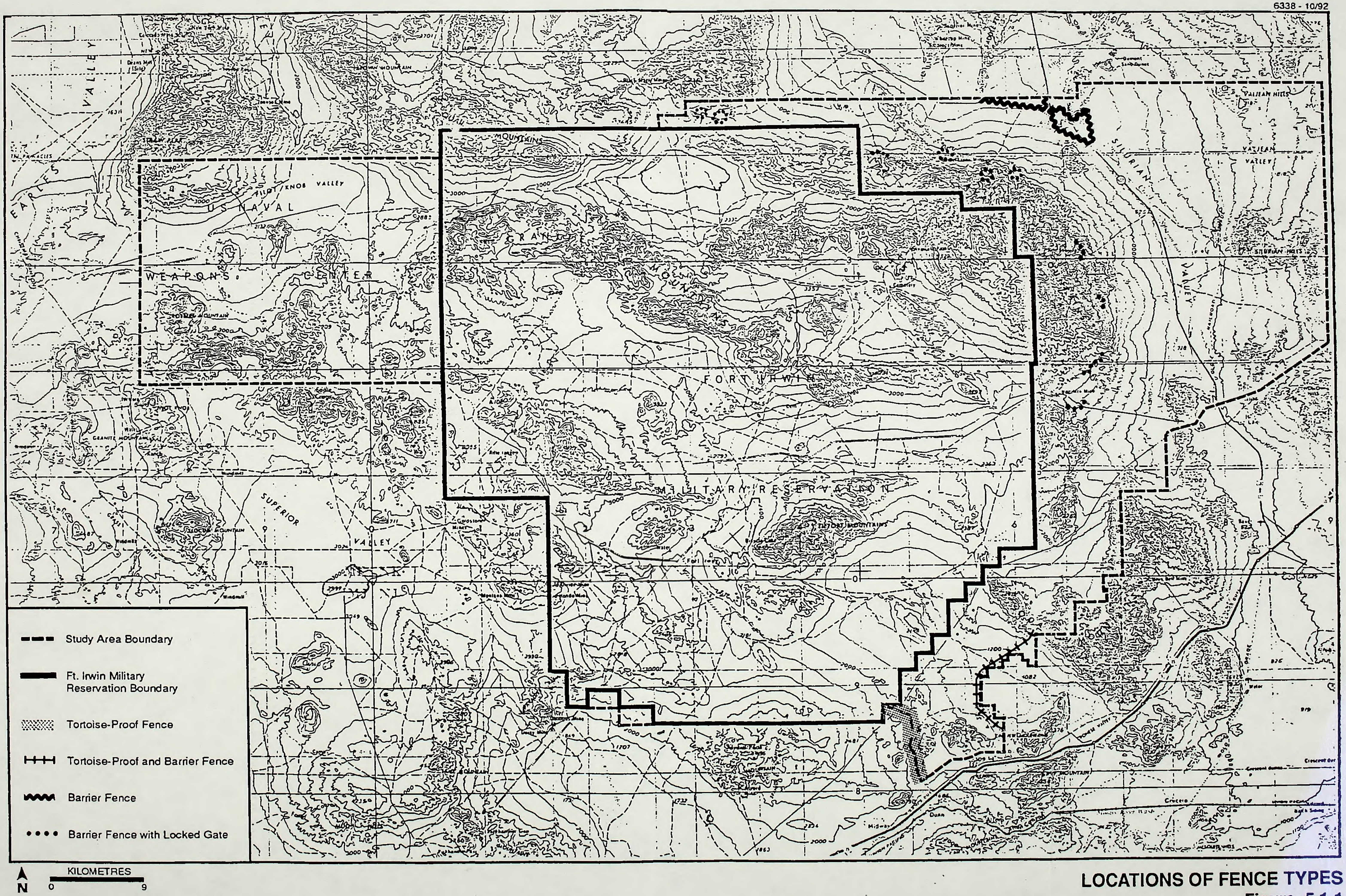

LOCATIONS OF FENCE TYPES
Figure 5.1-1

This measure will effectively protect tortoise populations located outside of maneuvering areas. It is estimated that 13.6 miles of tortoise fencing will be required at a cost of $571,200. Barrier fencing to segregate the Cronese ACEC, approximately 8 miles, will cost an estimated $200,000.

5.1.2 Tortoise Protection within Maneuver Areas

5.1.2.1 Dunn Road Area

Tortoise populations between Dunn Road and the Cronese ACEC, are shown (Figure 3.5-1) to be small. To prevent these animals from becoming geographically isolated, it is recommended they be utilized in a scientifically based relocation program to areas mutually agreeable to NTC, BLM, FWS, and California Fish and Game.

The cost for this action is estimated at $2,584,000 as outlined below:

Preparation and demographic study of receiving habitat (approximately 12 mi^2)	$400,000
Relocation of tortoise from approximately 12 mi^2 (3 years)	724,000
Equipment necessary to mark and monitor populations	35,000
Administrative expenses incumbent in carrying out research program (3 years)	75,000
Follow up studies at sites of relocation ($110,000/year for 10 years)	1,100,000
Additional demographic studies ($25,000/year for 10 years)	250,000
	$2,584,000

5.1.2.2 The Valjean Valley

Preliminary surveys in this important maneuver area indicate tortoise populations along the eastern perimeter of Valjean Valley and south of Silurian Hills to total numbers high enough to warrant special consideration. Initial measures should center around determining the exact size of the population. In order to allow time for this endeavor, tactical maneuvers east of the old railroad grade right-of-way (formerly Tidewater and Tonopah Railroad) will be restricted to scientific investigations and logistic/supply and administrative vehicular traffic on existing roadways. Unless the eastern tortoise population is much larger than preliminary estimates, it is planned to initiate a relocation to lands eastward.

It is proposed that tortoise be removed on a phased basis within those portions of the Silurian and Valjean Valley where tortoise signs were noted during surveys. Tortoises may also be removed from isolation within operation areas of the Mojave B Range.

The sweeps to remove tortoises from maneuver areas within the expansion would be initiated after approval of the NTC expansion. The receiving site will be surveyed, inventoried and tortoise marked prior to relocation. Army personnel would assist trained biologists in sweeping areas. Sweeps of tortoises for removal would occur in the spring, when tortoises are most active and the likelihood of encounter is the greatest. Additional lower intensity sweeps would continue during low activity times, such as summer and fall, relying more heavily on burrow inspection using fiber optic scopes or miniature video cameras to locate inactive tortoises. Sweeps would continue until the capture rate falls below the acceptable level established by the FWS. Potentially gravid female tortoises collected near the time of ovipositioning would be closely monitored following relocation to insure that eggs have been properly deposited in burrows. These clutches would be monitored to assess hatching success. Some of the located gravid females may be used in hatchling success studies described in Section 5.2.6. The monitoring of tortoises at the release sites would continue on each location for a minimum of three years. Tortoise spotting sweeps would be made every two weeks for the first two months following the release, twice the following spring, and once during the third spring.

Relocation of tortoises would be done in coordination with the CDFG and the FWS. On-going consultation with these agencies would be conducted to determine the success and adequacy of tortoise relocation.

The effort to relocate tortoises will be accompanied by a scientific data collection to monitor the success of the relocation, to improve the success of future relocations, and to collect base data on tortoises. Because of the longevity of the species, these investigations will require a minimum of one year to establish base line data. The major areas of investigation that will be addressed are:

- **The relative mortality and growth rates of relocated versus resident tortoises.** In particular, knowing the age specific and sex ratio impact of relocation is necessary in determining the best size of tortoise to move in the future. For instance, it may be shown that a particular age and sex class composition of tortoises in a local area may prove to result in the highest success in survivability and reproduction. To make such a determination, it is necessary to monitor the success of both relocated and resident tortoises where the relocated tortoises are released.

- **The patterns of tortoise movement.** Relocation provides an opportunity to determine the relative mobility of relocated and resident tortoises. Repeated sweeps for tortoises at the relocation sites would easily give valuable information on the distances moved by tortoises. Use of new technology in individual tagging, such as a silicon chip radio monitor may prove valuable in this situation.

- **The efficacy of food resource augmentation for increasing the success of relocation.** A simple experimental design can be used to determine the effectiveness of food augmentation on the survival of relocated and resident tortoises. Modification of this research program can be used to determine which foods or food combinations prove to have the greatest effect on survivorship and growth. By monitoring the growth, survival, and movement of tortoises resident in areas where relocated tortoises were moved, and those resident in matched, nearby sites with no tortoise additions, the effects of density on tortoise performance could be directly addressed.

- **The spread of URTD.** Repeated monitoring of relocated tortoises would establish the rate at which healthy animals would possibly show symptoms of URTD. As a control, some relocated tortoises should be held for up to 2 years in established quarantine areas to look for development of URTD in the absence of contact with other tortoises. Additionally, if any relocated animals are showing signs of URTD they should be isolated in quarantine areas. (There are several projects now underway or soon to begin which monitor infected tortoises to identify the pathology of the disease under different sets of environmental conditions, including changes in tortoise density and food resource regimes).

- **Demographic studies would be performed on each relocation site prior to introduction of additional animals in conjunction with the other proposed research studies.** This will provide needed baseline data on the specific demographic patterns in the resident tortoise population before and after the introduction of relocated individuals.

The above studies will be designed in such a way that will permit the proper statistical analysis of the resultant data base. Study protocol will include the establishment of control populations as a source of data to be compared with the results of experimental manipulations. Replicate study sites will be established as required by good statistical sampling protocol. All of these investigations will require the tagging of all involved tortoises and regular survey sweeps at which time relevant data is collected.

The cost for this action is estimated at $5,135,000 as outlined below:

Demographic study and preparation of receiving habitat (approx. 24 mi^2)	$ 800,000
Relocation of tortoise from approximate 24 mi^2 (3 years)	1,448,000
Equipment necessary to mark and monitor populations	87,000
Administrative Expenses incumbent in establishing research program (3 years)	150,000
Follow-up studies at sites of relocation (215,000/year for 10 years)	2,150,000
Additional demography studies $50,000/year for 10 years	500,000
	$5,135,000

5.1.2.3 Establishment of Preserves and Off-Limit Areas

Areas of special biological, cultural, archaeological, paleontological, and historical concern shall be protected by off limits signs, mapping, buffer areas, and barrier fencing. These areas include but may not be limited to:

- Salt Creek ACEC
- Amargosa River
- Owl Hole Springs/Mine
- Denning Spring ACEC
- Cottonwood Springs
- Sheep Creek Springs/Mine
- Old Mormon Springs
- Iron Mountain Wash/Mine
- Avawatz Crown Wash/Ruins
- Anvil Canyon Wash
- Riggs Site

- Valjean Site
- Renoville Site

Costs of installing 35 miles of barrier fencing is $875,000.

5.1.2.4 Hunting Restrictions

Hunting and fishing will not be allowed within any acquisition areas.

5.1.2.5 Southern Border Land

The approximately 4-square-mile (2,560-acre) expansion area on the southwestern portion of the current NTC boundary will be used for military, roads only, operations. The area contains several mining claims with open shafts that are potentially dangerous to both humans and wildlife. Acquisition of these acres would provide for logistics corridors.

5.1.2.6 East of Boulder (Utility) Corridor

The area east of the utility corridor will not be used for maneuvering. The area will be used for logistic support and administrative functions. The right-of-way will serve as an easily recognizable geographic feature for the containment of military exercises.

5.2 RESEARCH PROPOSALS

The following research proposals were provided by Dr. Peter Kareiva, of the University of Washington, who was responsible for developing the population viability models contained in the Chambers Group, 1991 Conservation Biology Report. The types of research programs suggested in this section are specifically designed to provide data to validate and improve the projection capabilities of the models. The resulting improvement in baseline data that is entered into the models will allow more accurate predicting capabilities and thus, make the models even more valuable when making management decisions regarding the desert tortoise. Additional data will lead to a greater overall understanding of desert tortoise biology which will aid in improving current management practices.

5.2.1 Quantity and Implementation

After the cost of the required research has been estimated, a public call for proposals to address the research questions should be conducted. A selected panel of scientists and agency leaders should convene to evaluate the proposals based on: 1) quality of research teams, i.e., past productivity of research teams, 2) soundness of research plans, and 3) likelihood of research to address pertinent desert tortoise concerns. The proposals should be funded on a 2.5 year basis, with an opportunity for renewal based on documented progress.

An additional cost of $110,000 would be added which represents the cost of convening two panel meetings (paying the panel members, secretarial help, travel, and so forth). The advantages of review by the panel will be:

- Better research; people will have to think clearly before embarking on any data collecting expedition, and will have the benefit of critical reviews prior to initiation of a project;
- More published papers in refereed journals, which then become a firm foundation for future decisions; and
- Enhanced credibility of results.

The following costs estimates are based on general guidelines of the National Science Foundation Panel on ecology and also on the Department of Energy panel on ecology in reviewing grant proposals for their science and budget. The costs are based on the award of money through a competitive grants process.

All of the research would be more informative if it was designed to take advantage of alternative management scenarios (e.g. grazing exclusion versus nonexclusion).

5.2.2 Tortoise Demographics

Data on the rates of reproduction, growth and survival in tortoises are extremely important for the purpose of desert tortoise conservation and management. Existing demographic data is fragmented or anecdotal. Data from demographic studies would be applied to the Conservation Biology Models, which would give the models a greater ability to predict the dynamic responses of tortoise populations to change. Typical topics to be studied include basic aspects of reproduction (clutch size and frequency, hatching success, and predation of nests), survival rates by age-specific classes of young tortoises, variation in growth rates by size-class, sex, and year, etc. These studies would be coordinated with FWS for guidance and could be conducted in the Western Mojave to yield data about this specific population. A minimum of three years is necessary to make this study valuable. The NTC proposes to continue this study for six years.

The cost estimates for a seven person team to conduct a six year study would be:

Year 1:	$140,000
Year 2:	120,000
Year 3:	120,000
Year 4:	140,000
Year 5:	120,000
Year 6:	120,000
TOTAL:	$760,000

A cost of $20,000 in the first and fourth year is included for purchase of necessary supplies and equipment.

5.2.3 Tortoise Dispersal

These studies characterize age-specific patterns of movement of tortoises in and out of areas over time. Recent studies of tortoise movement have relied on radio transmitter technology on small numbers of tortoises (usually less than 30). Because of associated costs and logistics problems, studies of this magnitude should not rely on radiotransmitter technology. For example, to distinguish between dispersal rates the conservation biology model identifies as critical (.05 versus .025), it would require too many radio-bearing tortoises. For instance, if one had 200 tortoises with radio transmitters, one would be trying to argue that 10 individuals moving is significantly different than five individuals moving. This would be hard to substantiate statistically. Furthermore, the technical logistics and cost involved with tracking 200 individual tortoise is prohibitive. Less expensive and simpler techniques, such as marking (paint or notching), or new inexpensive technology, such as microwave emitters, should be employed. These cost estimates do not include the installation of fences to eliminate dispersal in some regions (the fence treatment is needed as a "control" for the dispersal treatment).

This project would require ten workers but should yield good data within two years. The NTC has proposed to continue this study for at least four years.

Year 1:	$165,000
Year 2:	150,000
Year 3:	150,000
Year 4:	150,000
TOTAL:	$315,000

5.2.4 Viable Population Analysis

These studies will be designed to improve our understanding of the sensitivity of tortoise populations to environmental and demographic changes. This research should be conducted after the first round of demographic research and dispersal research have been completed. Using the data from those focused studies, it is envisioned that the viability research would be broader in geographic scale, would require appropriate modelling, and would take advantage of different management practices. Additional research on tortoise population genetics, pathology, and breeding structure will be included in this research.

The budget below assumes five sites and a modelling component:

Year 1:	$240,000
Year 2:	200,000
Year 3:	200,000
Year 4: (modelers brought into play in full force)	260,000
TOTAL:	$900,000

5.2.5 Total Cost of Research Proposals

Demography	$760,000.00
Dispersal	315,000.00
Viable Population	900,000.00
Panel Meetings (to award contracts)	110,000.00
TOTAL	$2,085,000.00
TOTAL YEAR 1	$655,000.00

According to Dr. Peter Kareiva, University of Washington, the aforementioned budgets are adequate, based on his experience running large field research programs. As an example, Dr. Kareiva's laboratory produces approximately five refereed published papers per $100,000 spent, most in journals such as Ecology, Nature, Oecologia, Journal of Ecology, Journal of Animal Ecology, etc. (which accept only 30 percent of the manuscripts they receive, and are widely read). The yield one should expect from research dollars is approximately five refereed published papers per $100,000 invested. When management related research is published in such journals, it is much easier to use that research to justify management decisions. Publications generated by the conservation programs will help to legitimize these research efforts and identify the new reserve as an important scientific and educational resource.

5.2.6 Juvenile Tortoise Research Project (JTREP)

The NTC is currently supporting a JTREP on the installation in cooperation with the University of California at Dominguez Hills and Southern California Edison. This program includes the construction of predator-proof pens which are located in an undisturbed area on Fort Irwin. Sweeps are made in the area surrounding these pens for gravid female tortoises, which are then verified by performing x-rays in the field. The female tortoises are placed in the pens until they lay their eggs. They are then returned to their home burrows. In the spring of 1990, 57 eggs were laid in the pens and 93 percent of the eggs hatched. This study will continue for several years and is targeted to determine the specific habitat food and other unique requirements of the juvenile tortoise. Cost of continuing this program is estimated to be $200,000 per year.

5.2.7 Army Pathology Lab Research

Because of the devastating negative effect of the disease, Upper Respiratory Tract Disease (URTD), Fort Irwin will fund increased research into the causes of the disease and more importantly into funding a possible cure or treatment for the disease. It is expected the U.S. military pathology lab will coordinate this research. Cost of $50,000 per year are anticipated with a 5-year period initially planned.

5.3 ESTABLISHMENT OF A CONSERVATION MONITORING WORKFORCE

The U.S. Army would requisition for and establish a minimum of two personnel to patrol and monitor all the fencing proposed in this Conservation Plan. They would also monitor the effectiveness of the off-limits areas to insure that proper controls were utilized in these areas. These personnel would identify problems and propose additional measures for restriction if necessary. These personnel are to have the proper training and permits from FWS to handle tortoises and to have established procedures in the event individual tortoises are found injured and in need of veterinary care. Additionally, these personnel would serve as the point of contact for fence maintenance and repair, reloading of tortoise decoys in buffer zones, and trail marking systems.

Two full-time personnel would work for the Directorate of Public Works, Fort Irwin, CA. They would have two four-wheel drive vehicles dedicated to them for their mission. Each biologist would be equipped with the necessary field equipment to identify, measure, and assess the general health of encountered tortoises. Relevant equipment includes field scales and flexible fiber optic scopes or miniature video cameras. These biologists are in addition to Range Control personnel and vehicles, whose current mission on the NTC is to control range training land. Additional Range Control personnel would also be required to monitor the ranges of an expanded NTC.

These personnel would be a considered high priority and the establishment of these positions would be immediate with approval of the project. It is anticipated that these positions would be filled within twelve months. In the interim, the Directorate of Public Works would task two current employees to do this work, and seek Range Control assistance as required. These interim personnel would be required to have completed a course in desert tortoise identification, handling, and general health assessment prior to being assigned to the field.

This measure would control the access into and out of the reserve and would provide for an expedient method to repair and maintain the fencing (and other control measures) contained in this conservation proposal. The monitoring would be extremely important in assessing the effectiveness of the measures and would provide for quick response to adjust them as required.

Two (2) ecologist/biologist ($150,000/year)	$ 150,000.00
Field equipment ($2,000 every 5 years)	2,000.00
Two (2) four-wheeled drive vehicles ($32,000 each)	64,000.00
TOTAL (for 30 years)	$4,896,000.00
TOTAL YEAR 1	$ 216,000.00

The future cost for the additional personnel is included in the total 30 year cost. Additionally, the total cost includes two new vehicles every five years and replacement of field equipment every five years.

5.4 EDUCATION

On-post education currently provided to soldiers would be expanded and education provided to family members and rotational units would continue with more emphasis being placed on awareness. Additionally, the contract and government workforce would be included in the educational program; targeting those who work on the ranges. Education focuses on desert ecology and the importance of eliminating adverse impacts to tortoises at work and while recreating. The penalties imposed for harming tortoises or their habitat is stressed to ensure that the education does not increase curiosity for those who would want to bring tortoises home. Additionally, personnel would be given the proper procedure for adopting a tortoise legally through the California Department of Fish and Game or local clubs.

In coordination with the NTC Public Affairs Office, an educational video will be prepared. This video will be shown at all briefings and made available to other groups on Fort Irwin (i.e., boy/girl scouts, Officer and Civilian Wives Club, and unit spouse groups).

Soldiers permanently stationed at the NTC would be provided with information on the tortoise in a formal briefing within 90 days of being assigned to the NTC and/or prior to any field activities in tortoise areas. Additionally, all spouses would be invited and encouraged to attend this quarterly briefing. School children on the post would have formal curriculum presented each school year during February or March prior to spring activity of tortoises, and during September or October prior to beginning traditional recreational activities in the desert. Informational bulletins and signs, pointing out penalties for disturbances, will be posted in conspicuous locations. Furthermore, timely educational notices would be posted in the weekly post newspaper and broadcast on the post information channel.

Rotational units are currently presented with desert ecology and desert tortoise information upon arrival to the NTC and prior to their field exercises. This briefing would continue with an expanded NTC and the penalties imposed for harming tortoises or their protected habitat would be stressed to these soldiers. The importance of the sanctity of off-limits areas would also be stressed.

These measures are ongoing but would be expanded to target more family members, children and those who work at the NTC. These measures would be in place prior to commencement of maneuver exercises in an expanded NTC area.

The initial cost for development of a video for troop orientation may cost approximately $60,000, with an additional $20,000 to update the video, as necessary. Additional informational handouts and posters would cost approximately $8,000 per year. Costs for development of a curriculum for classroom use by elementary and high school students who live on-post would be approximately $15,000. Total first year cost would be $83,000.

Video	$ 80,000.00
Classroom Curriculum	15,000.00
Literature	240,000.00
TOTAL	335,000.00
TOTAL YEAR 1	$ 83,000.00

5.5 CONSERVATION PLAN MANAGEMENT

The NTC would provide overall management for the Conservation Plan upon acceptance and approval of the conservation measures and measures that require phased implementation. A Management Plan would be prepared prior to the implementation of the conservation measures with input from the FWS and BLM. This Management Plan would outline the measures and funding required each year for thirty years and all actions that must occur. In accordance with the overall Management Plan, the NTC would prepare an annual report that includes the measures that have been accomplished and all research reports for the year. This Management Plan itself would be updated annually to incorporate recommendations provided in the annual reports and copies will be provided to cooperating agencies as necessary for review and comment.

The Management Plan would be prepared prior to the Record of Decision for the EIS. The implementation of this plan would occur after Congressional approval. The overall project manager responsible for this plan would be brought on to the Fort Irwin staff prior to any physical maneuvers on the land.

The overall project manager would be assigned to the Director of Public Works, Fort Irwin. This should be a military position (Captain). Cost estimates for this measure are $40,000.00 per year. The interrelationship of the managerial/biological functions of this position and the fact that land users are military, indicates effective control of the detailed conservation plan will best be accomplished by a member of the uniformed services. The total 30-year cost for this position is $1,200,000.00

5.6 SUMMARY OF COSTS FOR CONSERVATION MEASURES

Table 5.2-1 provides a summary of the conservation measures and their associated costs.

Table 5.2-1

SUMMARY OF COSTS

Conservation Measure	Year 1 Cost	Years 2-30 Cost	Total
1. Desert tortoise fencing along Dunn Road and Cronese Basin ACEC	771,200.00		$771,200.00
2. Fencing Portions of Boundary	$300,000.00		300,000.00
3. Translocation of tortoise from Cronese Basin	836,000.00	1,748,000.00	2,584,000.00
4. Phased Removal of Tortoises from North East Silurian and Valjean Valleys	1,685,000.00	3,450,000.00	5,135,000.00
5. Research	655,000.00	1,430,000.00	2,085,000.00
6. Juvenile Tortoise Research Project	200,000.00	2,900,000.00	3,100,000.00
7. Establish a Workforce to Monitor	216,000.00	4,770,000.00	4,986,000.00
8. Education	83,000.00	252,000.00	335,000.00
9. Conservation Plan Management	40,000.00	1,160,000.00	1,200,000.00
10. Army Pathology Lab Research	50,000.00	450,000.00	500,000.00
11. Establishment of Preserves and Off Limit Areas	875,000.00	1,000,000.00	1,875,000.00
Total	5,711,200.00	17,160,000.00	22,871,200.00

SECTION 6 - NET IMPACTS OF THE PROPOSED PROJECT

This section describes the net impacts of the proposed expansion following the implementation of all proposed conservation measures.

6.1 NET IMPACTS ON TORTOISE DENSITIES

Prior to the application of conservation measures, the proposed Silurian Valley/Mojave B Range acquisition would impact approximately 478,720 acres (748 square miles) of lands in the Western Mojave Desert. Once the four square miles, at the southern boundary of the NTC, are set aside and managed for tortoise the net impact on tortoise habitat will encompass approximately 476,160 acres (744 square miles). No maneuvers will occur within the four square miles and that area will be protected from civilian OHV use.

Following approval of the land acquisition project, the areas east of the old railroad grade, in the Silurian Valley, would be placed off-limits to maneuvers in order to protect the tortoise populations that reside in the Valjean Valley and adjacent to the Silurian Hills. This area encompasses approximately 72,512 acres (113.3 square miles). The only activities that will take place east of the railroad grade would be scientific investigations, logistic/supply, and administrative vehicular traffic. The vehicular traffic would be confined to existing roadways. Detailed scientific studies would be undertaken to determine the extent and the size of the tortoise populations. The present estimate of the tortoise population in the Valjean Valley and Silurian Hills is approximately 650 tortoises. The entire area east of the railroad grade is not considered good tortoise habitat but the railroad grade provides a visible boundary to designate off-limits areas. The initial impact of the acquisition would encompass approximately 403,840 acres (613 square miles). Eventually, following the detailed scientific investigations, the NTC would propose to relocate the tortoises from the Valjean Valley and the Silurian Hills to other habitat to the east. If relocation is acceptable, then the area east of the railroad grade would eventually be utilized for military maneuvers and the net impact of the acquisition would include approximately 476,160 acres (744 square miles).

Also following the approval of the acquisition, the tortoise populations in the Dunn Road area, approximately 240 tortoises, and in the Mojave B Range, approximately 180 tortoises, would be relocated to areas approved by the agencies. This would occur prior to maneuvers in these areas. The total number of animals relocated from these areas would be approximately 420 tortoises.

6.2 NET IMPACTS TO BLM INTERIM HABITAT MANAGEMENT CATEGORIES

Approximately 256 acres (0.4 square miles) of Category 1 habitat and 31,706 acres (49.5 square miles) of Category 2 habitat are encompassed by the proposed acquisition area. Since the

4 square miles at the southern boundary will be managed for tortoises, these lands will not be lost as tortoise habitat. They will no longer be under the jurisdiction of the BLM but they will continue to function as tortoise habitat. The four square miles include the 256 acres of Category 1 habitat and 1,024 acres of Category 2 habitat. The net impact on the Category 2 lands would be a loss of 30,682 acres (48 square miles). Technically there would be no loss of Category 1 habitat lands because the 256 acres would still be managed for tortoises.

SECTION 7 - CUMULATIVE IMPACTS OF THE PROPOSED PROJECT

This section describes the impacts of the proposed project as compared to the entire Mojave Desert, which encompasses both the California and the Nevada populations of the desert tortoise. In addition, the impacts of the proposed project are also compared to that portion of the desert tortoise population that occurs in the Western Mojave Desert of California.

7.1 CUMULATIVE IMPACTS TO THE MOJAVE DESERT TORTOISE POPULATION

Table 7.1-1 shows the estimated number of tortoise present in the California and Nevada portions of the Mojave Desert, which includes the California and Nevada populations of the desert tortoise. These tortoise numbers were estimated by Dr. Kristin Berry and cited in NERC, 1990. According to Dr. Berry there are approximately 308,465 to 530,688 tortoises in the California and Nevada portions of the Mojave Desert. The proposed NTC land acquisition would subject tortoises to take by removal for scientific purposes and by destruction from military activities. The scientific take would include the tortoise populations in the Dunn Road area (240 tortoises) and the Mojave B Range (180 tortoises). Initially, the Silurian Valley and Valjean Valley tortoise populations would be preserved and subjected to detailed scientific study. These populations include approximately 650 tortoises. If the area east of the railroad grade is included, assuming the entire 744 square miles in the acquisition area would be maneuvered on, a total of approximately 1,070 tortoises would be subject to scientific take through relocation programs. In other words, these tortoises would be removed from the acquisition area prior to the performance of maneuvers. These numbers represent approximately 0.35 to 0.20 percent of all of the tortoises in the California and Nevada portions of the Mojave Desert.

7.2 CUMULATIVE IMPACTS TO THE TORTOISE IN THE WESTERN MOJAVE DESERT

Table 7.1-1 also indicates the estimated number of tortoises present in the Western Mojave Desert. Approximately 162,221 to 215,846 tortoises are present in the Western Mojave Desert. These estimates were made by Dr. Kristin Berry and cited in NERC, 1990. The number of tortoises that would be subjected to scientific take, as a result of the proposed acquisition, represents approximately 0.66 to 0.50 percent of the tortoise population in the Western Mojave Desert.

Table 7.1-1

ESTIMATED PERCENTAGES OF TORTOISES SUBJECT TO SCIENTIFIC AND INCIDENTAL TAKE AFTER CONSERVATION MEASURES ARE APPLIED

Region	Total Number of Tortoises in the Region	Number of Tortoises in the Proposed Acquisition Area	Overall Percent of Tortoises Subject to Take by the Acquisition
Western Mojave	162,221-215,846*	1,070	0.50-0.66
California and Nevada Population	308,465-530,688*	1,070	0.20-0.35
*** Numbers of tortoise based on those in NERC, 1990.**			

Table 7.2-1 shows the areas of occupied desert tortoise habitat that would be impacted, by the proposed action, compared to the areas of occupied tortoise habitat in the Western Mojave Desert. Based on the total area of each tortoise density class within the Western Mojave Desert, approximately 5.6 percent of the tortoise habitat exhibiting densities of 0 to 20 tortoises/mi^2 occur within the entire Silurian Valley/Mojave B Range Alternative. In addition, approximately 1.2 percent of the 21 to 50 tortoises/mi^2 habitat, 0.48 percent of the 51 to 100 tortoises/mi^2, and 0.0 percent of the 101 to 250 tortoises/mi^2 also occur within the boundaries of the this alternative.

Table 7.2-2 compares the areas of occupied tortoise habitat by BLM Interim Habitat Management Categories in the Western Mojave. Approximately 0.03 percent of the Category 1 habitat in the Western Mojave Desert occur within the proposed land acquisition, but after the application of conservation measures none of this habitat would be impacted. The proposed land acquisition also contains approximately 8.7 percent of the Category 2 habitat that occurs in the Western Mojave Desert. The impacts to Category 2 habitat would be 8.4 percent following the application of conservation measures.

Table 7.2-1

AREA OF OCCUPIED DESERT TORTOISE HABITAT (in mi^2) BY TORTOISE DENSITY CATEGORY

Tortoise Density Category	Western Mojave	Silurian Valley/Mojave B Range
0-20	10330.2	582.8 (5.6%)
21-50	1354.7	16.9 (1.2%)
51-100	724	3.5 (0.5%)
101-250	395.4	0 (0%)

Percentages (in parenthesis) are based in the overall area of the Western Mojave.

Table 7.2-2

AREA OF OCCUPIED DESERT TORTOISE HABITAT (in mi^2), BY BLM HABITAT CATEGORY

BLM Habitat Category	Western Mojave	Silurian Valley/ Mojave B Range	Habitat Subject to Impacts After Conservation Measures
Category 1	1,409	0.4	0
Category 2	570	49.54	48

Percentages (in parenthesis) are based on the overall areas of the Western Mojave.

SECTION 8 - REFERENCES

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Township 27 South, Range 45 East
Township 27 South, Range 46 East
Township 27 South, Range 47 East
Township 28 South, Range 44 East
Township 28 South, Range 45 East
Township 28 South, Range 46 East
Township 28 South, Range 47 East
Township 29 South, Range 44 East

Township 29 South, Range 45 East
Township 29 South, Range 46 East
Township 29 South, Range 47 East

San Bernardino Meridian:

Township 11 North, Range 5 East
Township 12 North, Range 2 East
Township 12 North, Range 5 East
Township 12 North, Range 6 East
Township 13 North, Range 5 East
Township 13 North, Range 6 East
Township 13 North, Range 7 East
Township 14 North, Range 6 East
Township 14 North, Range 7 East
Township 14 North, Range 8 East
Township 15 North, Range 6 East
Township 15 North, Range 7 East
Township 15 North, Range 8 East
Township 16 North, Range 6 East
Township 16 North, Range 7 East
Township 16 North, Range 8 East
Township 16 North, Range 9 East
Township 17 North, Range 5 East
Township 17 North, Range 6 East
Township 17 North, Range 7 East
Township 17 North, Range 8 East
Township 17 North, Range 9 East
Township 18 North, Range 3 East
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APPENDIX C

U.S. FISH AND WILDLIFE SERVICE BIOLOGICAL OPINION ON THE PROPOSED ACTION

United States Department of the Interior

FISH AND WILDLIFE SERVICE

ECOLOGICAL SERVICES
VENTURA FIELD OFFICE
2140 EASTMAN AVENUE, SUITE 100
VENTURA, CALIFORNIA 93003

April 29, 1994

Memorandum

To: State Director, Bureau of Land Management, Sacramento, California

From: Field Supervisor, Ecological Services - Ventura Field Office, Ventura, California

Subject: Biological Opinion for the National Training Center's Proposed Land Acquisition Project, San Bernardino County, California (CACA 33285 2310 6840 CA-932.5) (1-8-94-F-12R)

This biological opinion responds to your request for formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (Act). The Department of the Army (Army) has proposed to expand the National Training Center (NTC) at Fort Irwin to accommodate larger scale training maneuvers. The Bureau of Land Management (Bureau), pursuant to an interagency agreement with the Army, submitted a request for formal consultation, which was dated November 29, 1993, and received by us on December 6, 1993, on the proposed action. At issue are the impacts that the proposed expansion may have on the desert tortoise (Gopherus agassizii), a federally listed threatened species, and its designated critical habitat.

This biological opinion was developed by using information supplied to the Service by the Bureau in its November 29 request for formal consultation and in a letter to the Service from the Army, dated October 20, 1993 (Army 1993b). Information previously supplied by the Army (Chambers 1991a, Chambers 1992a, Chambers 1992b, and Chambers 1992c) and from our files was also used to complete this biological opinion.

The Service's involvement with the land acquisition project began with a biological resource inventory and subsequent report for potential expansion areas to the west, south, and east of the NTC (Service 1988). Subsequently, in 1990 and 1991, Service staff participated in a work group with the Army, Bureau, and other agencies to evaluate the information that would be required for a biological assessment and environmental impact statement.

On June 7, 1991, the Army requested formal consultation with the Service for a proposed expansion that would have resulted in the loss of 314 square miles of desert tortoise habitat, primarily south of the existing NTC. On September 20, 1991, the Service delivered a draft jeopardy biological opinion, with two reasonable and prudent alternatives to the Army and the Bureau.

In late 1992, the Army submitted and then withdrew a proposal that included portions of the Naval Air Weapons Station, China Lake. Although the maps attached to this document indicate that a portion of the Naval Air Weapons Station is included in the study area for the land acquisition project, Navy lands are not part of the NTC's proposed action and are therefore not considered in this biological opinion.

In April, 1993, the NTC proposed acquisition of 515.2 square miles (329,710 acres) of public, private, and state land to the north, east, and south of its existing boundaries (Chambers 1992b). The Service estimated that full training use of the areas proposed for acquisition would have resulted in the loss of at least 69 square miles of desert tortoise habitat, in the Silurian and Valjean Valleys, and between Dunn Road and the Soda Mountains. On August 19, 1993, the Service issued a non-jeopardy biological opinion with terms and conditions to reduce the take of desert tortoises by decreasing the area that would be transferred to the Army. The expansion proposal evaluated in this biological opinion is a result of discussions among the Service, Bureau, and Army that were held subsequent to the issuance of the August 19 biological opinion.

On March 14, 1994, the Service provided a draft non-jeopardy biological opinion to the NTC and Bureau for comment. The NTC and Bureau provided comments to the Service, via correspondence dated March 24, 1994, and April 1, 1994, respectively. The information contained in the correspondence was incorporated into this final biological opinion.

Biological Opinion

It is the opinion of the Service that the proposed action is not likely to jeopardize the continued existence of the desert tortoise or result in adverse modification of its critical habitat.

Description of the Proposed Action

The existing NTC occupies 1,004 square miles, located 30 miles northeast of Barstow in San Bernardino County (attachment 1). The Army proposes to expand the NTC by acquiring approximately 518 square miles (331,200 acres) of public, private, and state land to the north, east, and southeast of its existing boundaries. The Bureau administers 482 square miles of this total. The State of California holds title to 25 square miles and the remaining 8 square miles are privately owned. The Army has withdrawn its proposal to acquire lands below the UTM 38 90 gridline (Army 1993a).

Descriptions of the need for additional training area and the summary of military doctrine are contained in Chambers (1992b). The results of a land use requirement study, conducted by the Army in 1985, indicated that an additional 238,000 net maneuverable acres (372 square miles) were needed at the NTC to train brigade-sized combat units. A second land use requirement study was conducted by the Army in 1993 that concluded 222,000 acres of maneuverable lands were required. The Army considers maneuverable areas to be lands with slopes of less than 20 percent. Because the lands surrounding Fort Irwin include a large portion of mountainous terrain, the Army has proposed acquisition of a larger area than that recommended in the land use requirement study.

Training for AirLand Operations, as the modern U.S. war fighting doctrine is called, involves tanks, armored personnel carriers, wheeled vehicles, various aircraft, and air-delivered mines and chemical contamination operating over large areas. The NTC currently maintains a two-battalion force composed of tracked and wheeled vehicles that opposes other units which are rotated to Fort Irwin from around the country approximately 14 times per year (Chambers 1991a). Most of the equipment for the rotated forces is maintained on base. Under existing conditions, distances and other aspects of training battles are corrected administratively to simulate larger battlefields (Chambers 1991a). The NTC uses lasers and an electronic monitoring system during battles to simulate weapons fire and to detect strikes.

Current operations and potential for future expansion are also constrained by location of the existing features at Fort Irwin. These features include NTC's cantonment area, where housing and operations facilities are located, the Tiefort and Granite Mountains, the Air Force's Leach Lake impact area, the Goldstone Deep Space Tracking Center, and Fort Irwin Road (Chambers 1991a).

The biological assessment prepared by the Chambers Group (1992b) for the April 1 request for formal consultation described several measures that the Army would undertake to mitigate the adverse effects of the proposed action on the desert tortoise. These measures, as modified by the Army's October 20, 1993, letter to the Service, are summarized below:

1. Desert tortoise-proof and barrier fencing would be installed along the boundary of the training area southeast of the geological feature known as the Whale to prevent desert tortoises from entering the newly acquired lands. Attachment 1 depicts the location of the proposed fencing.

2. Pathways would be developed around the southern end of the Whale to provide an east-west corridor for tactical vehicles in the southern portion of Fort Irwin. This corridor would allow the use of Army lands north of UTM 91.5 that are currently difficult to use. The Boulder utility corridor would serve as an easily recognizable feature for the containment of military exercises elsewhere.

3. Demographic studies of the desert tortoise population in the Cronese Valley would be initiated to determine whether isolation, translocation, or some other strategy is in the best interest of the species.

4. Land acquired in the Silurian and Valjean Valleys would be managed under the Compliance Agreement between the Army and the Service. The Compliance Agreement was developed in response to a biological opinion issued by the Service (1-6-91-F-42) to the NTC for its ongoing training activities in 1991. Features of this agreement that are pertinent to the proposed acquisition include:

   a. Enforcement of a one kilometer buffer around desert tortoise habitat containing over 20 desert tortoises per square mile through the use of (MILES), updated training maps, restricted area signs, and other measures (attachment 2).

   b. Monitoring of the effects of training and mitigation measures on desert tortoises and their habitat.

   c. Wherever possible, development of permanent stabilized staging areas and the restriction of training activities to these areas.

5. Hunting and fishing would be prohibited.

6. The Army also proposes to fund several research efforts on desert tortoises, including studies of demographics, dispersal, and population analyses. These research proposals would be "specifically designed to provide data to validate and improve the projection capabilities of the (population viability) models" contained in Chambers (1991b), which was prepared in support of the Army's proposed Modified Coyote Basin alternative (Chambers 1991a).

7. The Army would continue to fund the juvenile desert tortoise research project, which is a cooperative effort with California State University, Dominguez Hills, and Southern California Edison.

8. The Army's pathology laboratory would fund research into finding the cause of and a cure or treatment for upper respiratory tract disease.

9. The Army would establish a minimum of two personnel to patrol and monitor all proposed fencing and the effectiveness of the off-limits areas; serve as the point of contact for fence and signage repairs; and mark trail systems. The decoys are training mines designed to resemble desert tortoises, which would detonate upon impact by a vehicle. Because all users of the NTC are instructed to avoid desert tortoises, the Army believes the decoys would be effective educational devices for both environmental and training purposes.

10. On-post education, designed to increase awareness of natural resource values with emphasis on the desert tortoise, would be provided to soldiers, family members, and contract and government workers. An educational video would be produced and made available to various groups at Fort Irwin.

11. The Army would prepare a management plan, in coordination with the Service, that would outline the conservation measures and required funding for each year for 30 years. The NTC would also prepare an annual report detailing the measures that have been implemented and the research conducted during that year.

Effects of the Proposed Action on the Listed Species

Species Account

On August 4, 1989, the Service published an emergency rule listing the Mojave population of the desert tortoise as endangered. On April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened through publication of a final rule. The Service has prepared a draft recovery plan, which underwent public review in the spring of 1993.

A final rule designating critical habitat for the desert tortoise was published in the Federal Register on February 8, 1994 (Service 1994). The rule became effective on March 10, 1994.

The desert tortoise is a large, herbivorous reptile found in portions of the California, Arizona, Nevada, and Utah deserts. It also occurs in the states of Sonora and Sinaloa, Mexico. Generally, desert tortoises are active during the spring and early summer when annual plants are most common. Additional activity occurs during warmer fall months and occasionally after summer rain storms. Desert tortoises spend the remainder of the year in burrows, escaping the extreme weather conditions of the desert. When desert tortoises are away from their burrows, shrubs provide important cover sites, which provide protection from thermal stress and predation, and often act as focal points for feeding activity (Woodbury and Hardy 1948).

Further information on the range, biology, and ecology of the desert tortoise can be found in Burge (1978), Burge and Bradley (1976), Hovik and Hardenbrook (1989), and Weinstein et al. (1987).

Desert tortoises inhabit the southern portion of the NTC and adjacent public and private lands, in an area extending roughly from the Paradise Range on the west to the Whale on the east (attachment 3). Desert tortoises within this area are generally considered to be part of the western Mojave Desert population (Service 1993b). Surveys conducted by the NTC documented desert tortoises along the eastern perimeter of Valjean Valley and south of the Silurian Hills (Chambers 1992c). Desert tortoises in the Valjean and Silurian Valleys are considered to be within the eastern Mojave recovery unit for the desert tortoise (Service 1993b).

Desert tortoises occur in several plant communities within the action area, although they are generally absent from areas of extremely rocky substratum, steep slopes, and its lowest and hottest portions. These communities include Mojave creosote bush scrub, Joshua tree woodland, saltbush scrub, Mojave wash scrub, and crucifixion thorn woodland. General information on these community types can be found in Barbour and Major (1988). Bagley (1989) contains specific information on the plant species found in the study area. The Service's (1988) resource inventory contains additional information on both the plant and animal species of the project area. The project area also supports open playas, freshwater seeps, saline hills, stabilized and partially stabilized sand fields, active desert dunes, and some areas of "intense disturbance" (Chambers 1992b). Although these latter community types are generally not considered desert tortoise habitat, desert tortoises may occasionally travel through or otherwise use such areas.

Information on the distribution and relative abundance of desert tortoises within the study area was developed over several years. In 1988 and 1989, 90 and 468 standard desert tortoise transects, respectively, were walked south of Fort Irwin within the original proposed land acquisition area (Service 1991). The Army conducted an additional 298 transects along the southern boundary of the NTC in 1992, also as part of the original land acquisition proposal (Chambers 1992a). None of the above survey efforts extended north of the southern edge of the Avawatz Mountains or east of State Highway 127. The Army conducted 248 transects in 1992 to estimate the densities of desert tortoises within the lands added to its most recent proposal for acquisition (Chambers 1992c).

The area occupied by desert tortoises in the Silurian and Valjean Valleys is 23 square miles (Chambers 1992b). This habitat has been designated as interim Category 3 habitat by the Bureau. The lands proposed for acquisition near the Whale cover approximately 15 square miles of designated Category 1 and 2 desert tortoise habitat (Chambers 1992b). The Bureau and other agencies, such as the California Department of Fish and Game, generally regard Category 1 and 2 habitat as being of high quality for desert tortoises and as manageable in terms of land ownership patterns.

Desert tortoises also occur within the NTC along the southern and southeastern boundaries as far north as the Whale. Areas near the NTC's edges are not currently used for large-scale training maneuvers because of the proximity to the boundary. These areas have received and continue to receive occasional, mostly minor, impacts from Army activities. However, they have, in large part, been protected from military and other activities by administrative actions enacted by the NTC to prevent Army vehicles from straying off-base. The presence of the NTC boundary has also likely reduced the use of this area by recreationists.

Analysis of Impacts

The following impact analysis evaluates the potential effects of military training and the Army's conservation program as it is currently proposed. If present within training areas, desert tortoises and their burrows would be crushed by military vehicles during exercises. Shrub cover, which provides desert tortoises with protection from thermal stress and predators, and concentrations of annual plants for foraging, would also eventually be eliminated by the proposed action. For example, shrub cover decreased from 5.8 percent in 1983 to 1.9 percent in 1989 on the lower bajada within the southern training corridor. By comparison, a bajada within the Goldstone area, which is off-limits to training, supported cover of 19.9 percent in 1989 (NTC 1991). The Army estimates that these impacts would occur in all maneuver areas where the slope is less than 20 percent (Chambers 1992b).

Analysis of the distribution of desert tortoises and the force-on-force maneuver areas on the existing NTC indicates that desert tortoises cannot survive in areas where large scale military maneuvers occur. Figure 6 from the NTC's biological assessment for the ongoing mission (1991) depicts the locations of habitat currently supporting desert tortoises on the base (attachment 4). The figure preceding section 3 (attachment 5) and figure 7 (attachment 6) show existing training corridors and the density of vehicle tracks, respectively (NTC 1991). Comparison of the maps in these three figures clearly demonstrates that the training exercises conducted on the NTC eliminate desert tortoises and their habitat.

The desert tortoise is a long-lived species with a low reproductive rate. Recovery of the native shrub vegetation to the levels of cover and species diversity that occurred prior to training would require several decades, given the slow growth rates of most desert species and the uncertainties of annual rainfall. Therefore, expansion of the NTC would result in the eventual extirpation of desert tortoises and long-term, if not permanent, loss of their habitat wherever force-on-force maneuvers would occur. Habitat degradation also occurs in areas used only for logistic support and administrative functions, such as when troops bivouac (Bransfield, personal observation).

If the Army is able to conduct training exercises within the expansion area along existing routes and corridors that it establishes, the loss of desert tortoise habitat and individual animals would be less than that described in the previous paragraph. However, these differences would be impossible to quantify at this time because the feasibility of set routes and training areas has not been determined by the NTC.

The effects of the proposed land acquisition and subsequent training on the desert tortoise and its habitat located along the current southeastern boundary of the NTC must be also considered in this biological opinion (attachment 4). The NTC's current use of the UTM 90 gridline to separate training activities, which occur north of this line, from viable desert tortoise habitat to the south would not be affected by the current proposal. The area north of the UTM 90 line along the western edge of the Whale formerly supported desert tortoises. This area was heavily used for training in the past; however, maneuvering in this area became difficult with the establishment of the 90 gridline as a southern limit to training. Although the lands west of the Whale and north of the UTM 90 gridline would become available for military exercises under the current proposal, the Service believes that the effects on desert tortoises would be minimal because past use of this area has likely eliminated its value as habitat.

Full training use of the areas proposed for acquisition would result in the loss of at least 29 square miles of desert tortoise habitat within the proposed land acquisition area (Army 1993b). Based upon a review of information provided by the Army during the formal consultation on the NTC's current mission (attachment 4), the Service estimates that approximately one square mile of desert tortoise habitat, supporting a density of approximately 20 animals per square mile, would be eliminated within the existing boundaries of Fort Irwin if training is conducted along the fort's boundaries.

If the expanded NTC conducts maneuvers in a manner similar to current operations, some habitat would likely remain in a less disturbed condition near the expanded boundaries and on slopes with grades greater than 20 percent. These areas receive fewer impacts because of the previously described administrative actions and the inability of tracked vehicles to travel on steep slopes, respectively.

We are unable to define and quantify the areas that would not likely be destroyed for the reasons noted in the preceding paragraph. Given the limited area they would occupy after expansion and the generally low number of desert tortoises currently existing in them, it is likely that these boundary areas would not be able to maintain viable desert tortoise populations.

Common ravens (Corvus corax) are often attracted to areas of human activity by trash and discarded food. The augmented food source provided by human activities has resulted in elevated numbers of common ravens in some areas of the desert. At least some common ravens have preyed on young desert tortoises in large numbers. The attraction of common ravens, which have been observed to gather at trash piles left after training exercises at the NTC (Bransfield personal observation), to the new training areas could be an indirect effect of the proposed action.

The NTC has proposed several measures, summarized previously in this biological opinion, designed to mitigate the impact of the expansion and subsequent training actions. The components of this plan include: the construction of fencing to prevent desert tortoises from entering training areas in the Cronese Basin; placing training restrictions on areas in the Silurian and Valjean Valleys; attempting to develop permanent staging areas; and research activities on various aspects of desert tortoise biology.

The Army's proposal does not specifically describe the fate of desert tortoises that may occur within training areas. The largest numbers of desert tortoises are expected to occur between the proposed desert tortoise-proof fence in the Cronese Basin and current training areas within Fort Irwin. The Army has proposed to continue discussions with the Service and the Bureau to determine the most appropriate solution to the fate of these animals. Possible solutions include translocation to the Cronese Basin outside of the NTC, use in research or breeding programs, or adoption.

The Service recognizes the numerous problems associated with these possible solutions. Relocation of desert tortoises is an unproven technique. Also, the use of desert tortoises in research or for adoption remains a loss to wild populations, and as such, constitute take of a listed species. The previous biological opinion on the Army's proposed expansion discussed these issues in detail (Service 1993a). The Service also recognizes that the Army's alterations to the expansion proposal have reduced the potential loss of desert tortoise habitat and the take of individual desert tortoises.

The Army's commitment to resolve this issue in the future cannot ensure the fate of the individual animals that may be removed from training areas. However, its willingness to retain flexibility in its approach to solving the problem jointly with the Service and the Bureau should ensure that the mitigation efforts would not endanger adjacent populations of desert tortoises.

Large numbers of desert tortoises are not expected to be encountered elsewhere within the expansion area. When individual desert tortoises are found and may be at risk from training exercises, procedures outlines in the Compliance Agreement between the Service and the Army would be used to resolve the situation, on a case-by-case basis.

Desert tortoises in the Valjean and Silurian Valleys represent the westernmost extension of the eastern Mojave population of the species. Conversely, desert tortoises in the Cronese Basin are the easternmost animals of the western Mojave Desert population. Thus, the proposed action would not fragment desert tortoise populations, but could lead to reduced genetic diversity, if the viability of populations at the edges of the ranges are compromised. From a long-term perspective, implementation of the proposed action may also reduce the potential for transfer of genetic material between the eastern and western Mojave Deserts, if climatic changes would allow the colonization by desert tortoises of the lowlands between the Avawatz Mountains and the Silurian Hills.

The proposed expansion area would include 15 square miles of designated critical for the desert tortoise. The habitat quality of the areas west of the Whale has previously been affected by military training activities conducted by the Army. In many places, the constituent elements of critical habitat for the desert tortoise, which are substrate suitable for burrowing, shrub cover, and native annual plants, no longer exist. The Service estimates that approximately three square miles of former habitat west of the Whale no longer provide suitable habitat.

Approximately one square mile of the proposed expansion area included within the critical habitat designation, the Whale itself, supports at most only a limited number of desert tortoises. The constituent elements are naturally absent or widely scattered on this geologic feature that is mostly composed of volcanic extrusions.

Within the proposed expansion area, lands which currently contain the constituent elements necessary for the survival of desert tortoises occupy approximately eleven square miles. The barrier fence proposed by the NTC (attachment 1) would preclude the use of approximately five square miles of critical habitat by tactical vehicles. Therefore, the Service estimates that approximately six square miles of designated critical habitat would be adversely affected by the proposed action.

The Superior-Cronese Critical Habitat Unit covers 766,900 acres of the West Mojave Recovery Unit, as defined by the draft recovery plan for the desert tortoise (Service 1993b). The loss or degradation of approximately 6,400 acres of habitat, of which approximately 2,560 acres no longer support the species for natural or human-related reasons, should not prevent the desert tortoise from reaching the target populations identified for the western Mojave Desert.

The Service believes the impacts described above are not likely to jeopardize the continued existence of the species or result in the adverse modification of critical habitat. We have reached these conclusions for the following reasons:

1. The proposed action, which would cause the loss of up to 29 square miles of desert tortoise habitat, would not result in significant additional fragmentation of the species' habitat. The desert tortoise habitat that would be affected, in the northern portion of the Cronese Basin, supports the eastern extension of the western Mojave population of desert tortoises.

2. The loss of 29 square miles of desert tortoise habitat, and the individual animals this habitat supports, is not likely to result in extirpation of western Mojave Desert population of the species. Sufficient individuals are likely to remain within suitable habitat to maintain the long-term viability of both populations.

3. The loss of 29 square miles of desert tortoise habitat, and the individual animals this habitat supports, is not likely to prevent the western Mojave recovery unit from achieving the target population level of desert tortoises, as described in the draft recovery plan (Service 1993b).

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur in the project area. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project.

Many of the actions that are reasonably expected to occur within the vicinity of the expansion will be subject to section 7 consultations, because large portions of the desert are managed by Federal agencies. Actions by the private sector, such as urbanization and the take of individual desert tortoises related to the indirect effects of urbanization, have resulted in large-scale losses and degradation of habitat in the Mojave Desert.

For example, the cities of Ridgecrest, Adelanto, Barstow, Victorville, and Las Vegas, among others, are located in historic desert tortoise habitat. Much of the following discussion pertains to the western Mojave Desert. The Service is unaware of any pending private or State actions reasonably expected to occur within the eastern Mojave Desert that would alter the conclusions contained in this biological opinion.

The cumulative impacts analysis conducted by the Chambers Group (1990) for the original proposed expansion of the NTC assessed habitat quality in the western Mojave Desert by quantifying human impacts on eleven 1:100,000 scale quadrangles. The proposed expansion area is located within the Soda Mountains quadrangle.

The cumulative impacts analysis conducted by Chambers (1990) indicated that 300 square miles of the habitat within the study area, which covered most of the western Mojave Desert, fell within the "light to moderate" and "least disturbed" categories. The study also rated 195 square miles as having "moderate to heavy" disturbance. The least disturbed areas were generally located in the eastern portion of the study area, largely outside of desert tortoise habitat. This assessment of habitat disturbance provides important information on habitat trends, although the high altitude photography on which the evaluation was based places certain limits on its usefulness.

The draft recovery plan notes that "(m)any desert tortoise populations have declined at rates ranging between 3 and 59 percent per year" and that areas with a high incidence of human-related mortality show the greatest declines (Service 1993b). Thus, the results of the cumulative impacts conducted by Chambers (1990) are significant in noting the relatively undisturbed nature of the eastern portion of the western Mojave Desert. Although the eastern portion of the proposed land acquisition area was not included in the cumulative impact analysis, it also remains fairly undisturbed by virtue of its remoteness from areas of high human use.

The Chambers Group, in its population viability analysis for the proposed expansion project, noted that high mortality rates in the reproductive size classes and the decreased proportion of desert tortoises in the juvenile and immature size classes indicate a population decline (1991b). The long-lived nature of the species and the natural low survival rate of immature animals, compounded at present by excessive predation by common ravens, virtually ensure that any reversal of this decline will be very slow.

The presence and uncertain resolution of the problem of upper respiratory tract disease further exacerbate the decline. In 1989, desert tortoises with signs of this disease were observed at the Desert Tortoise Natural Area, in the Rand Mountains and

Fremont Valley, near Kramer Junction, near Lenwood, on Edwards Air Force Base, and in Stoddard and Lucerne Valleys. These sightings indicate that the upper respiratory tract disease now occurs in the western (Desert Tortoise Natural Area, Rand Mountains and Fremont Valley), central (Kramer Junction, Lenwood, and Edwards Air Force Base), and southern (Stoddard and Lucerne Valleys) portions of the desert tortoise's range in the western Mojave Desert. Mortality rates are expected to remain high.

The largest area of known occurrence of upper respiratory tract disease, 772 square miles, is in the region covered by the Cuddeback Quadrangle, located west of the proposed action area (table 3.1-14, Chambers 1990). This area also ranks high in the categories which enumerate areas of "high probability of occurrence and high mortality rates" and of "high probability of occurrence" with a further 565 square miles potentially being affected by upper respiratory tract disease. By contrast, as noted above, the Soda Mountains Quadrangle, in which the proposed action is located, has the second lowest potential for upper respiratory tract disease of the quadrangles covered in the cumulative impacts analysis. The Army's biological assessment notes that only one desert tortoise with symptoms of upper respiratory tract disease, found along Fort Irwin Road, has been documented near the NTC (Chambers 1992b).

The presence of abundant habitat loss and degradation and upper respiratory tract disease throughout much of the western portion of the western Mojave Desert management unit for the desert tortoise, extending eastward through the Cuddeback Quadrangle, significantly worsens the prospects for the survival and recovery of the desert tortoise. The relative remoteness of the habitat along both sides of the NTC's southern border, including the proposed land acquisition area, and the almost complete lack of upper respiratory tract disease enable this land to support possibly the most stable desert tortoise population in the western Mojave Desert.

The Service has contacted the Counties of Inyo, San Bernardino, Kern, Riverside, and Los Angeles (and the incorporated areas within the desert) regarding the listing of the desert tortoise and its implications for county- and city-permitted activities. The Bureau, the Service, the California Department of Fish and Game, and several cities and counties are cooperating in the development of the West Mojave Coordinated Management Plan, which would use a programmatic approach to mitigating and compensating the effects of both non-federal and Federal actions on the desert tortoise and numerous sensitive species. The Plan would serve as a habitat conservation plan, in support of section 10(a)(1)(B) incidental take permits from the Service, which several local jurisdictions in San Bernardino, Inyo, Los Angeles, and Kern Counties have expressed interest in obtaining.

Incidental Take

Section 9 of the Act prohibits the take of listed species without special exemption. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Under the terms of section 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this incidental take statement. The measures described as reasonable and prudent measures and terms and conditions in this biological opinion are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

This biological opinion anticipates the following take which would be associated with implementation of the reasonable and prudent measures:

> All desert tortoises within the proposed land acquisition area where military training would occur as a result of the acquisition through mortality or injury inflicted by training activities or harassment resulting from mitigation efforts intended to prevent desert tortoises from being harmed by training. The Service anticipates that no more than 29 square miles of desert tortoise habitat would be affected by training exercises made possible by the proposed expansion.

This biological opinion does not authorize any form of take that is not incidental to the proposed land acquisition project of the NTC and subsequent training activities.

If the incidental take authorized by this opinion is met, the Bureau or the Army shall immediately notify the Service in writing. If the incidental take authorized by this opinion is exceeded, the Army shall immediately cease the activity resulting in the take and the Bureau shall reinitiate formal consultation with the Service.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the incidental taking authorized by this biological opinion:

1. The Bureau shall recommend to the Army, as a condition of withdrawal if the public lands are transferred, that the NTC

implement measures to reduce, to the maximum extent possible, the potential for interaction between desert tortoises and training exercises on any lands obtained as a result of expansion. For example, education programs, defined training areas, and well-defined operational procedures shall be implemented to reduce the take of desert tortoises and loss of their habitat during training activities.

2. The Bureau shall recommend to the Army, as a condition of withdrawal if the public lands are transferred, that the NTC reduce the attraction of common ravens to training sites in the land acquisition area to the maximum extent possible.

Terms and Conditions

In order to be exempt from the prohibitions against the take of listed species, contained in section 9 of the Act, the Bureau shall recommend that the Army, as the Federal agency implementing the proposed action, comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions could be included in any legislation used to withdraw these lands from Bureau management. Terms and conditions 1a through 1h were contained in the Army's description of the proposed action and are slightly modified herein by the Service.

1. To implement reasonable and prudent measure 1, the following terms and conditions are established:

   a. Prior to the onset of training exercises within the land acquisition area, the Army shall install desert tortoise-proof and barrier fencing along the boundary of the training area southeast of the geological feature known as the Whale to prevent desert tortoises from entering the newly acquired lands. Attachment 1 depicts the location of the proposed fencing.

   b. Prior to the onset of training exercises within the land acquisition area, the Army shall develop pathways around the southern end of the Whale to provide an east-west corridor for tactical vehicles in the southern portion of Fort Irwin.

   c. Demographic studies of the desert tortoise population in the Cronese Valley shall be initiated to determine whether isolation, translocation, or some other strategy is in the best interest of the species. The development and implementation of such studies shall be coordinated with the Service and the Bureau. The California Department of Fish and Game and the National Biological Survey should be notified of the studies and provided the opportunity to assist in study design.

d. Land acquired in the Silurian and Valjean Valleys shall be managed under the Compliance Agreement between the Army and the Service. Features of this agreement that are pertinent to the proposed acquisition include:

1. Enforcement of a one kilometer buffer around desert tortoise habitat containing over 20 desert tortoises per square mile through the use of multiple integrated laser engagement system (MILES), updated training maps, restricted area signs, and other measures (attachment 2). Training maps, signing, and other applicable methods to prevent use of these areas by tactical vehicles shall be in use prior to the onset of training.

2. Monitoring of the effects of training and mitigation measures on desert tortoises and their habitat.

3. Wherever possible, development of permanent stabilized staging areas and the restriction of training activities to these areas.

e. Hunting and fishing shall be prohibited.

f. The Army shall establish a minimum of two personnel to patrol and monitor all proposed fencing and the effectiveness of the off-limits areas; serve as the point of contact for fence repairs; reload desert tortoise decoys in buffer zones; and mark trail systems.

g. On-post education, designed to increase awareness of natural resource values with emphasis on the desert tortoise, shall be provided to soldiers, family members, and contract and government workers. An educational video shall be produced and made available to various groups at Fort Irwin. At a minimum, the education program shall contain information on the locations of desert tortoise protection areas, the protective measures in force, and the penalties for the unauthorized take of a listed species.

h. The Army shall prepare a management plan, in coordination with the Service and the Bureau, that would outline the conservation measures and required funding for each year for 30 years. The NTC shall also prepare an annual report detailing the measures that have been implemented and the research conducted during that year.

i. The Army shall develop procedures to undertake if desert tortoises are encountered within training areas. The Service shall be provided an opportunity to review and approve the plan, at least 30 days prior to its intended implementation. These procedures shall include, at a minimum:

   1. identification of trained personnel who would be responsible for handling desert tortoises brought in from the field;

   2. standard techniques for handling desert tortoises, including excavation of burrows, as described in Arizona Game and Fish et al. (1991); and

   3. contingency plans for placing desert tortoises that are retrieved from training areas.

2. To implement reasonable and prudent measure 2, the following term and condition is established:

a. All trash and refuse shall be promptly contained and regularly removed from the training areas to reduce their attractiveness to common ravens and other desert tortoise predators.

Disposition of Sick, Injured, or Dead Specimens

Upon locating dead, injured, or sick desert tortoises, initial notification must be made to the Service's Division of Law Enforcement in Torrance, California, at (310) 297-0062 within three working days of its finding. The Service's Ventura Field Office should be notified concurrently at (805) 644-1766. Written notification must be made within five calendar days and include the date, time, and location of the carcass, and any other pertinent information. Additionally, a photograph should be taken, when possible. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state.

If the withdrawal proceeds, the Bureau shall recommend that the Army, as the Federal agency implementing the proposed action, place the remains of intact desert tortoises with educational or research institutions holding the appropriate State and Federal permits per their instructions. If such institutions are not available or the shell has been damaged, the information noted above shall be obtained and the carcass left in place. The Bureau or Army should consider marking the carcass in a manner that would not be toxic to other wildlife to ensure that it would not be re-recorded in the future, particularly if the carcass is in an area that might continue to support desert tortoises.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution by the Army through a biologist prior to implementation of the action. Injured animals should be transported to a qualified veterinarian. Should any treated tortoises survive, the Service should be contacted regarding the final disposition of the animals.

Conservation Recommendations

In furtherance of the purposes of the Endangered Species Act (sections 2(c) and 7(a)(1)) that mandate Federal agencies to utilize their authorities to carry out programs for the conservation of listed species, we recommend implementing the following actions:

1. The NTC should initiate efforts to take an active role in the recovery of the desert tortoise. These efforts could include cooperative management of desert tortoise populations that occur on both Army and Bureau lands, continued support of ongoing research efforts on the NTC, and increased cooperation among biologists from the Department of the Army and other Federal and State agencies. Formal participation in planning efforts for the West Mojave Coordinated Management Plan could constitute a means of undertaking such recovery efforts.

2. The Bureau and the Army should continue to investigate alternatives that would further reduce the effects of the proposed action on desert tortoises and their habitat. The Service believes that a more complete evaluation of the use of simulation training, which would be particularly useful in reducing the ground-disturbing effects of military training, should be undertaken.

3. The Bureau should also consider alternatives to withdrawal of public lands, such as right-of-way reservations for specified supply routes and staging areas that could further reduce the loss of desert tortoise habitat and individual animals.

The Service requests notification of the implementation of any conservation recommendations so we can be kept informed of actions that either minimize or avoid adverse effects, or that benefit listed species or their habitats.

Conclusion

This concludes formal consultation on the proposed land acquisition project for the National Training Center at Fort Irwin. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is reached; 2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this biological opinion; or 4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16). Any questions or comments should be directed to Ray Bransfield at the Ventura Field Office at (805) 644-1766.

Attachments:
1 Location of desert tortoise-proof and barrier fencing in Cronese area
2 Location of restricted areas in Silurian and Valjean Valleys
3 Figure 3.5-1 from Chambers 1992b
4 Figure 6 from National Training Center 1991
5 Existing military scenario exercise from National Training Center 1991
6 Figure 7 from National Training Center 1991

Craig Faanes

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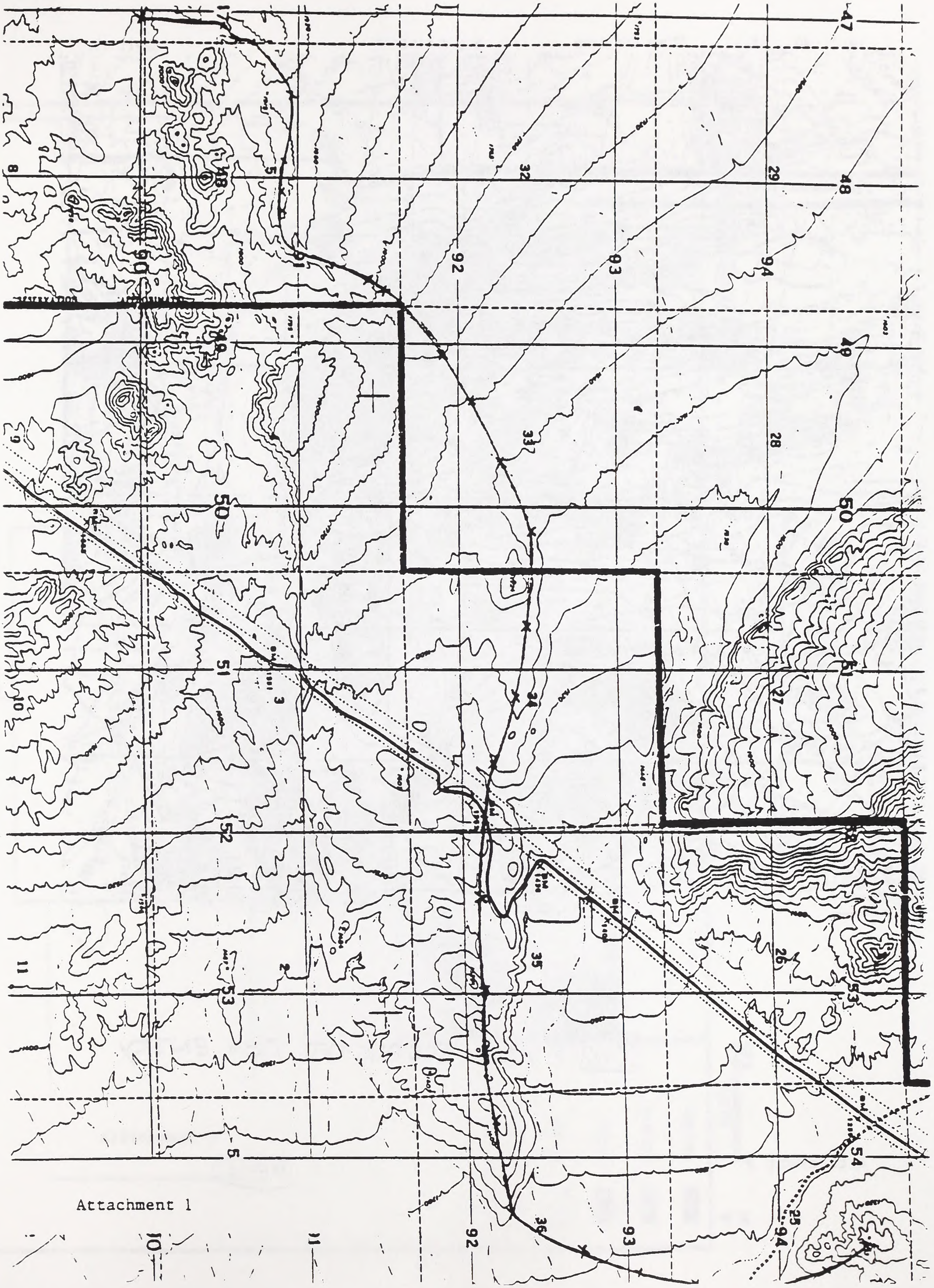
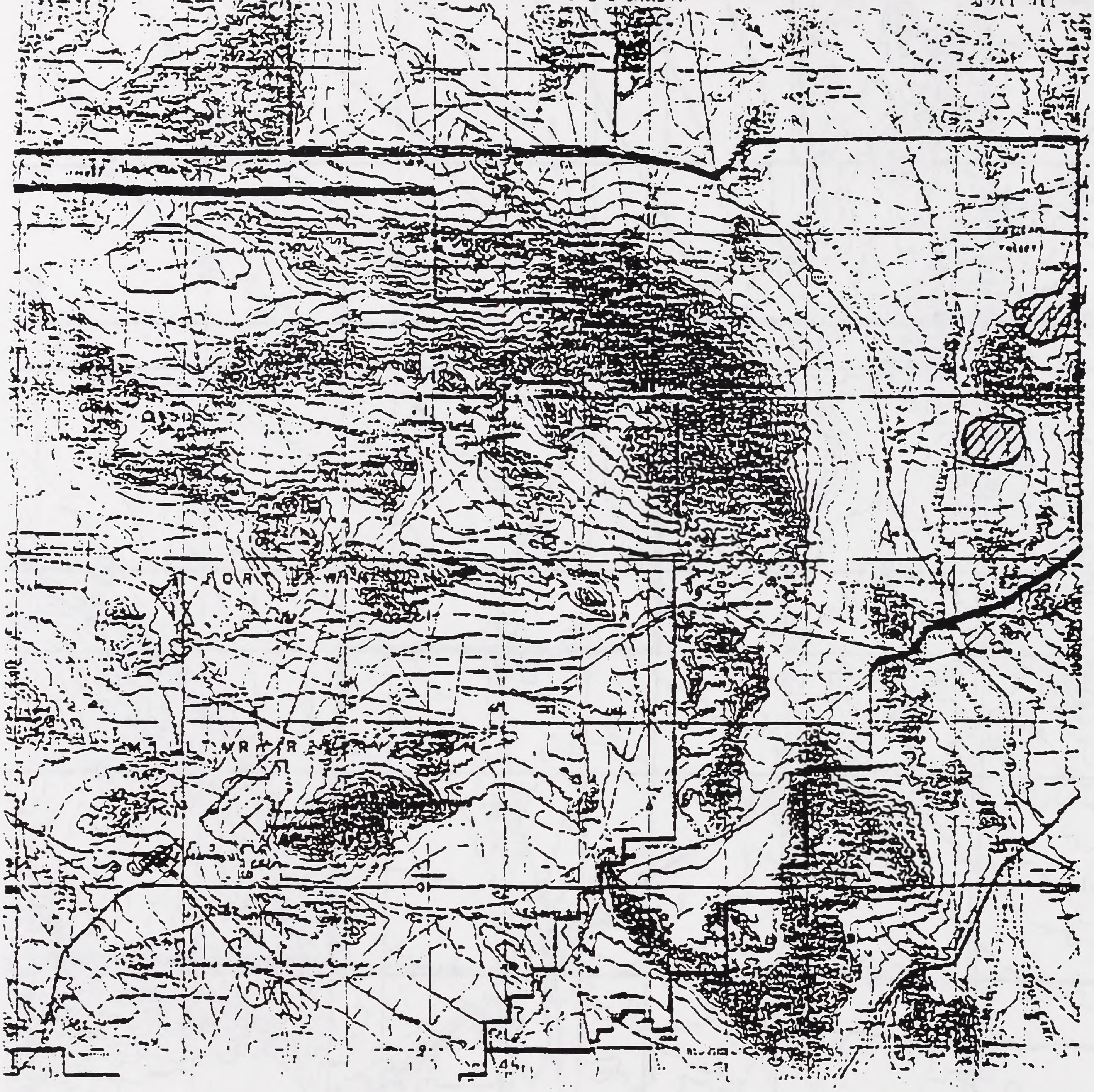


Attachment 1

10/21/93 15:17 ☎619 256 6109 B L M BARSTOW ☎011/011

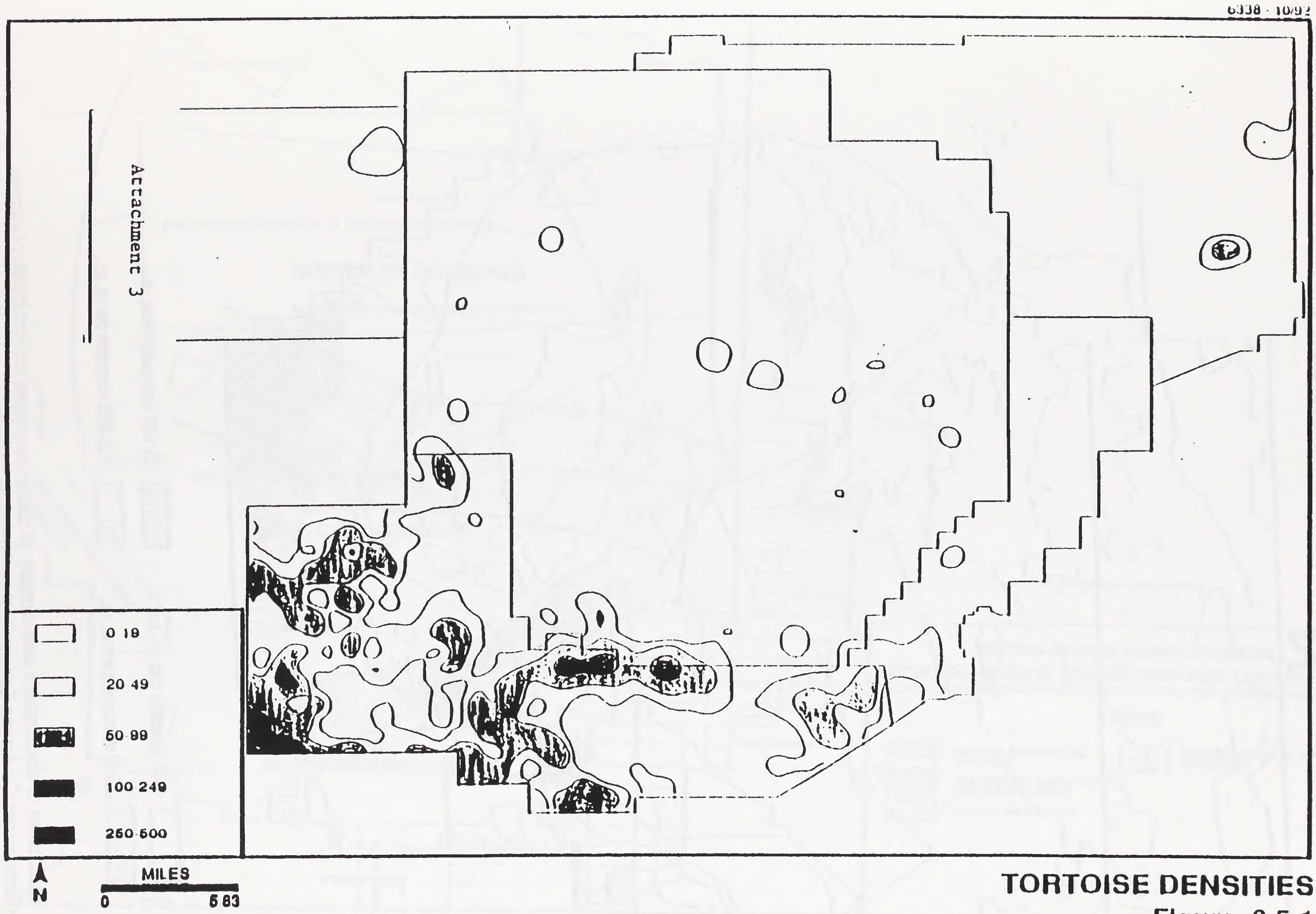


▨ = AREAS RESTRICTED FROM ENTRY

Attachment 2

MAP 3

Attachment 3



TORTOISE DENSITIES
Figure 3.5-1

Attachment 4

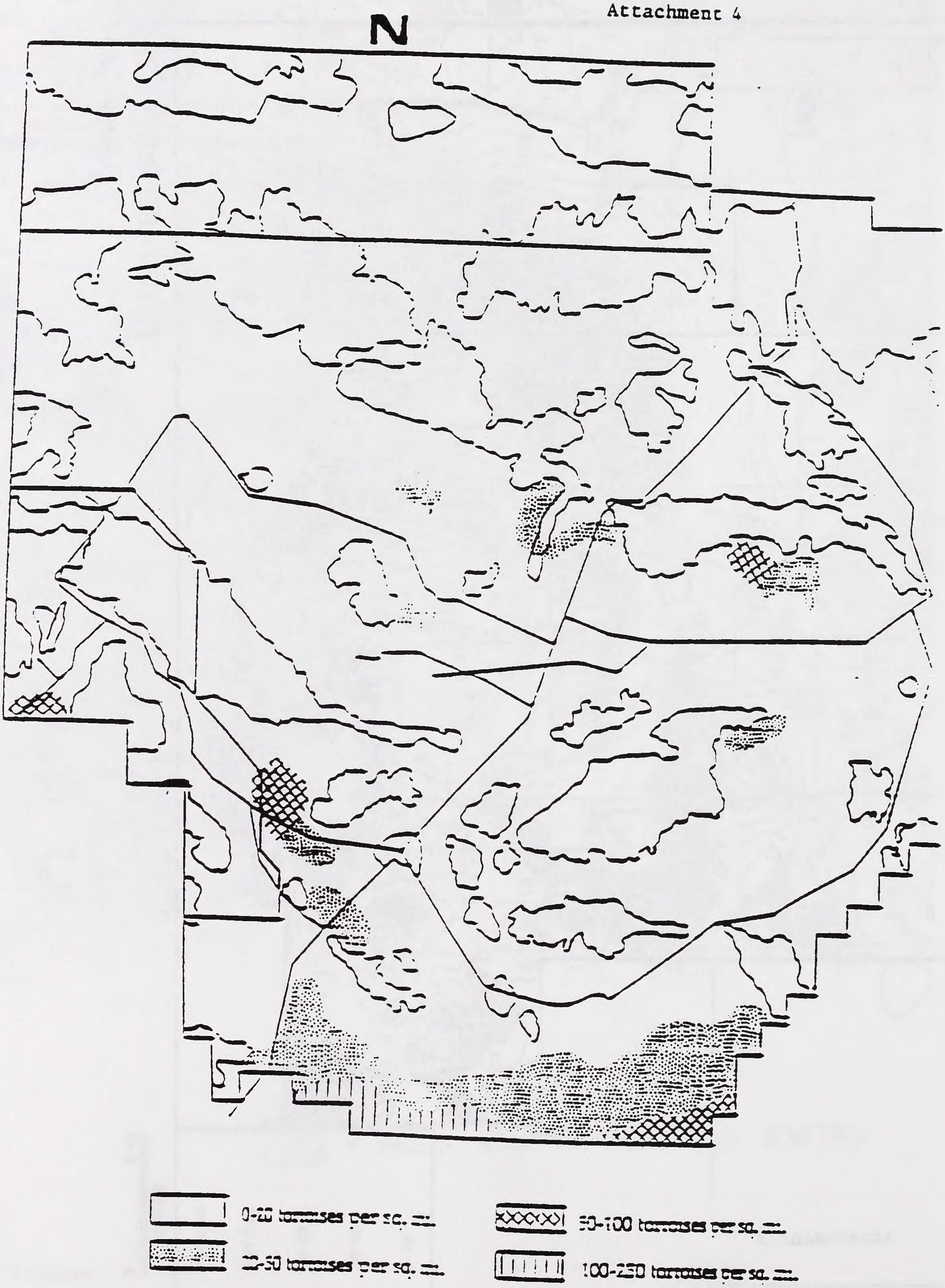
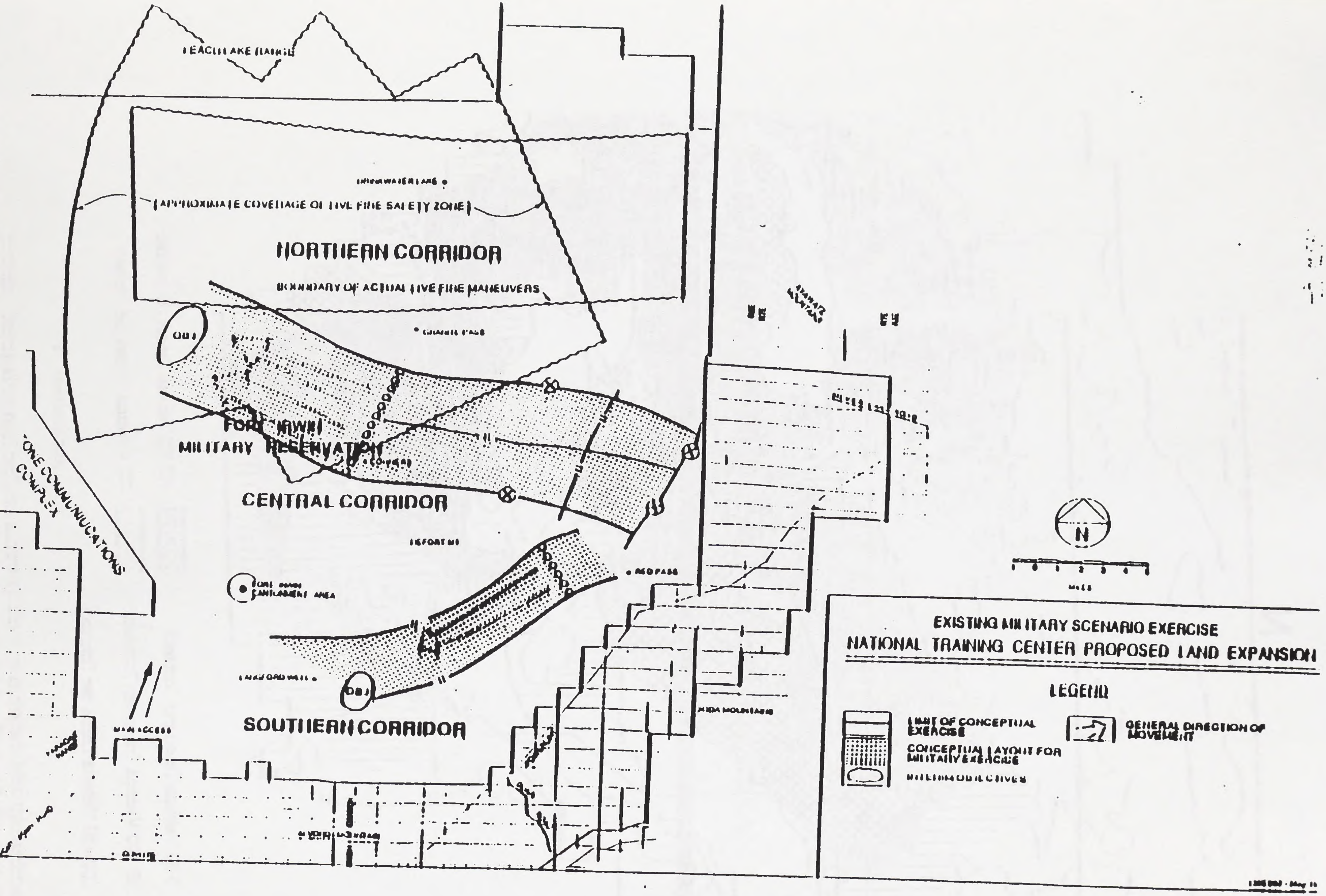
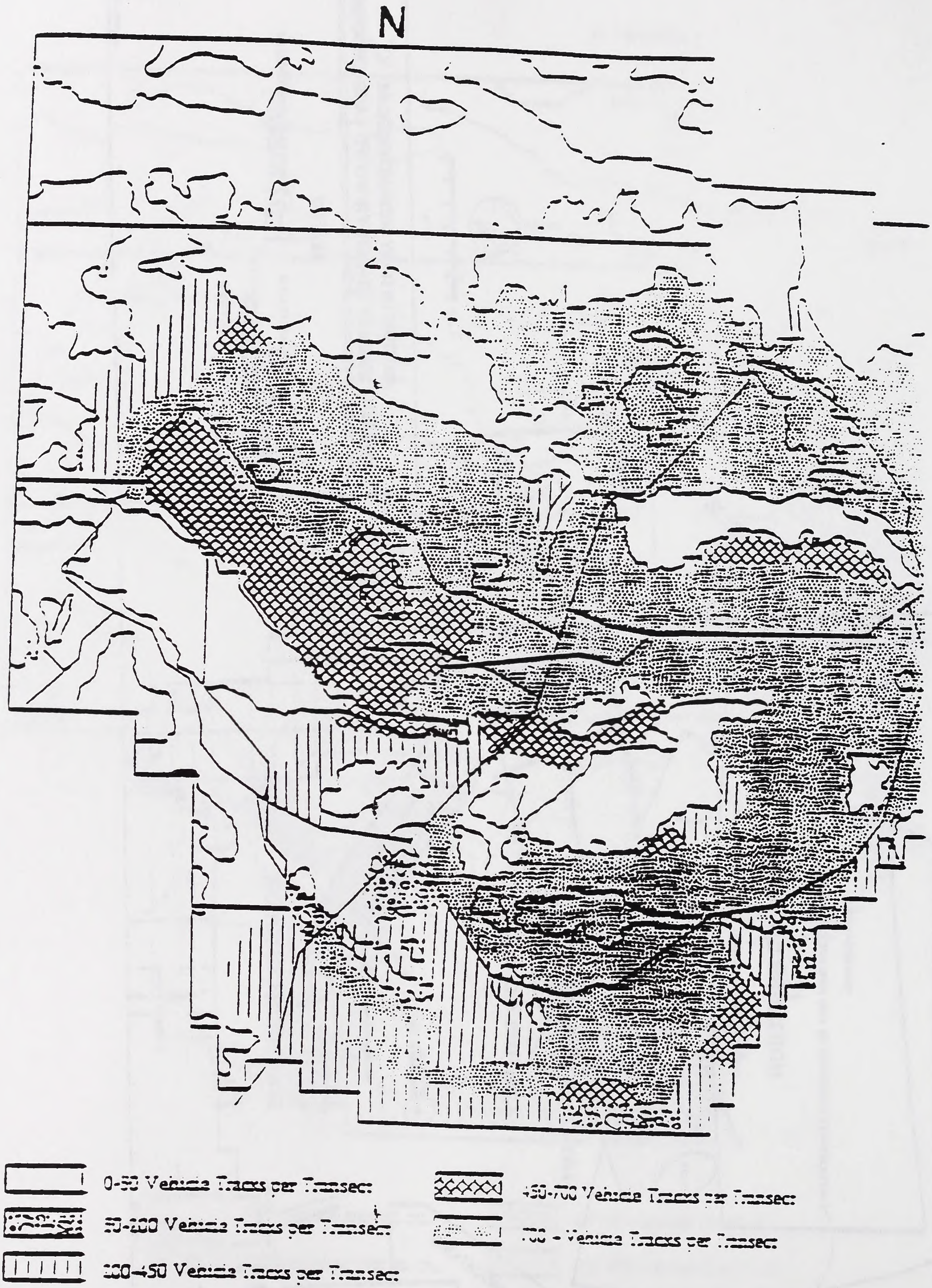

N
0-20 tortoises per sq. mi.
20-50 tortoises per sq. mi.
50-100 tortoises per sq. mi.
100-250 tortoises per sq. mi.

Figure 6. Estimates of distribution and density of desert tortoises on Fort Irwin, National Training Center and Goldstone Space Communications Complex.

Attachment 5


EXISTING MILITARY SCENARIO EXERCISE
NATIONAL TRAINING CENTER PROPOSED LAND EXPANSION
LEGEND
LIMIT OF CONCEPTUAL EXERCISE
CONCEPTUAL LAYOUT FOR MILITARY EXERCISE
GENERAL DIRECTION OF MOVEMENT
MILES
N
LEACH LAKE RANGE
(APPROXIMATE COVERAGE OF LIVE FIRE SAFETY ZONE)
NORTHERN CORRIDOR
BOUNDARY OF ACTUAL LIVE FIRE MANEUVERS
OBJ
FORT IRWIN
MILITARY RESERVATION
CENTRAL CORRIDOR
FORT IRWIN CANTONMENT AREA
OBJ
SOUTHERN CORRIDOR
MAIN ACCESS
ONE COMMUNICATIONS COMPLEX
SODA MOUNTAINS
RED PASS


N
0-50 Vehicle Tracks per Transect
50-200 Vehicle Tracks per Transect
200-450 Vehicle Tracks per Transect
450-700 Vehicle Tracks per Transect
700 + Vehicle Tracks per Transect

Attachment 6

Figure 7. Distribution and densities of vehicle tracks on Fort Irwin National Training Center and Goldstone Space Communications Complex.

APPENDIX D

PLANT SPECIES LIST FOR THE STUDY AREA

Appendix D
PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
FERN AND FERN-ALLIES	
PTERIDACEAE	**BRAKE FAMILY**
Cheilanthes parryi	Parry lip fern
GYMNOSPERMS	
CUPRESSACEAE	**CYPRESS FAMILY**
Juniperus osteosperma	Utah juniper
EPHEDRACEAE	**EPHEDRA FAMILY**
Ephedra californica	California ephedra/desert tea
Ephedra funerea	Death Valley ephedra
Ephedra nevadensis	Nevada ephedra/Nevada joint-fir
Ephedra viridis	green ephedra/mountain joint-fir
ANGIOSPERMS-DICOTS	
AMARANTHACEAE	**AMARANTH FAMILY**
Amaranthus albus *	tumbling amaranth
Tidestromia oblongifolia	tidestromia/Arizona honey-sweet
APIACEAE	**CARROT FAMILY**
Cymopteris aboriginum	white cymopteris
Cymopteris panamintensis	panamint cymopteris
Lomatium mohavense ssp. mohavense	Mojave wild parsley
APOCYNACEAE	**DOGBANE FAMILY**
Apocynum cannabinum (=*A.c.* var. *glaberrimum*)	Indian hemp
ASCLEPIADACEAE	**MILKWEED FAMILY**
Asclepias erosa	desert milkweed
Asclepias subulata	rush milkweed
Sarcostemma hirtellum	trailing townula
ASTERACEAE	**SUNFLOWER FAMILY**
Acamptopappus sphaerocephalus	goldenheads
Adenophyllum cooperi (=*Dyssodia c.*)	Cooper's dyssodia
Ambrosia dumosa	burro-weed
Amphipappus fremontii ssp. *fremontii*	chaff-bush
Artemisia ludoviciana	silver wormwood
Artemisia spinescens	budsage
Artemisia tridentata	Great Basin sagebrush
Atrichoseris platyphylla	tobacco weed
Baccharis emoryi	Emory baccharis
Baccharis sergiloides	squaw waterweed/desert baccharis
Baileya pauciradiata	desert marigold/lax flower
Baileya pleniradiata	woolly marigold
Bebbia juncea var. *aspera*	sweetbush
Brickellia arguta	spearleaf brickelbush
Brickellia desertorum	desert brickelbush
Brickellia incana	woolly brickelbush
Brickellia microphylla	small-leaf brickelbush
Calycoseris parryi	calycoseris/yellow tackstem
Chaenactis carphoclinia var. *carphoclinia*	pebble pincushion
Chaenactis fremontii	Fremont's pincushion/desert pincushion

PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
ASTERACEAE (Continued)	**SUNFLOWER FAMILY (Continued)**
Chaenactis macrantha	Mojave pincushion/large-flowered pincushion
Chaenactis stevioides	desert pincushion/gray-leaved pincushion
Chrysothamnus nauseosus	rubber rabbit brush
Chrysothamnus paniculatus	wash rabbit brush/black-stem
Chrysothamnus teretifolius	needleleaf rabbit brush
Chrysothamnus viscidiflorus	sticky rabbit brush
Cirsium neomexicanum	New Mexico thistle
Coreopsis bigelovii	Bigelow's coreopsis
Dicoria canescens	desert dicoria/bugseed
Encelia actonii	Acton daisy
Encelia farinosa	incienso/brittlebush
Encelia frutescens	green brittlebush/button encelia/rayless encelia
Ericameria cooperi	Coopers goldenbush
Ericameria cuneata var. *spathulata* (=*Haplopappus c.*)	cliff goldenbush
Ericameria linearifolia (=*Haplopappus l.*)	interior goldenbush
Erigeron pumilus var. *intermedius*	fleabane
Eriophyllum ambiguum	woolly daisy
Eriophyllum wallacei	Wallace's woolly sunflower/Easter bonnets
Filago depressa	dwarf filago
Geraea canescens	desert sunflower/hairy-headed sunflower
Glyptopleura marginata	glyptopleura
Gutierrezia microcephala	sticky snakeweed/matchweed
Hymenoclea salsola	cheese bush/burrobrush
Isocoma acradenia (=*Haplopappus acradenius*)	alkali goldenbush
Lactuca serriola	prickly lettuce
Lepidospartum squamatum	scale-broom
Machaeranthera arida	silver lake daisy/arid aster
Machaeranthera carnosa (=*Aster intricatus*)	broom alkali-aster
Malacothrix coulteri	snake-head
Malacothrix glabrata	desert dandelion
Malacothrix sonchoides	malacothrix
Monoptilon bellioides	desert star
Nicolletia occidentalis	hole-in-the-sand plant
Palafoxia arida var. *arida* (=*P. linearis*)	spanish needle
Perityle emoryi	rock daisy
Peucephyllum schottii	pigmy-cedar
Pleurocoronis pluriseta	arrowleaf
Pluchea sericea	arrow weed
Porophyllum gracile	odora/poreleaf
Prenanthella exigua (=*Lygodesmia e.*)	prenanthella
Psathyrotes annua	fan-leaf
Psathyrotes ramosissima	turtleback
Rafinesquia neomexicana	desert chicory
Senecio flaccidus var. *monoensis* (=*S. douglasii v. m.*)	sandwash groundsel sandwash/ragwort
Senecio mohavensis	Mojave groundsel/ragwort
Solidago confinis	southern goldenrod
Sonchus oleraceus *	common sow-thistle
Stephanomeria exigua ssp. *exigua*	annual mitra/stephanomeria
Stephanomeria parryi	Parry's stephanomeria/Parry's rock pink
Stephanomeria pauciflora var. *pauciflora* (=*S. myrioclada*)	desert straw/wire lettuce
Stylocline sp.	nest-straw

PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
ASTERACEAE (Continued)	**SUNFLOWER FAMILY (Continued)**
Syntrichopappus fremontii	Fremont xerasid
Tetradymia argyraea	silver horsebrush
Tetradymia stenolepis	Mojave cotton thorn/Mojave horsebrush
Uropappus lindleyi (=*Microseris linearifolia*)	silver puffs
Viguiera reticulata	viguiera
Xylorhiza tortifolia (=*Machaeranthera t.*)	Mojave aster
BIGNONIACEAE	**BIGNONIA FAMILY**
Chilopsis linearis ssp. *arcuata*	desert willow
BORAGINACEAE	**BORAGE FAMILY**
Amsinckia tessellata	fiddleneck/Devil's lettuce/checker fiddleneck
Amsinckia vernicosa	fiddleneck
Cryptantha angustifolia	narrow-leaved cryptantha
Cryptantha barbigera	bearded cryptantha
Cryptantha circumscissa	capped forget-me-not
Cryptantha confertiflora	golden cryptantha
Cryptantha costata	ribbed/ashen cryptantha
Cryptantha decipiens (=*C. corollata*)	gravel cryptantha
Cryptantha holoptera	winged cryptantha
Cryptantha maritima (incl var. pilosa)	coastal cryptantha
Cryptantha micrantha	red-root forget-me-not
Cryptantha nevadensis	Nevada forget-me-not
Cryptantha pterocarya	wingnut forget-me-not
Cryptantha racemosa	woody forget-me-not
Cryptantha tumulosa (sensitive)	New York Mountains cryptantha
Cryptantha utahensis	scented popcorn flower
Cryptantha virginensis (=*C. hoffmanii*)	popcorn flower
Heliotropium convolvulaceum var. *californicum*	heliotrope/false morning glory
Heliotropium curassavicum var. *oculatum*	Chinese pusley
Pectocarya heterocarpa	pectocarya
Pectocarya platycarpa	broad-nutted comb-bur
Pectocarya recurvata	recurved pectocarya/curved comb-bur
Pectocarya setosa	erect/bristly pectocarya/round comb-bur
Plagiobothrys jonesii	popcorn flower
Tiquilia plicata (=*Coldenia p.*)	tiquila/plicate coldenia
BRASSICACEAE	**MUSTARD FAMILY**
Arabis sp.	rock cress
Arabis suffrutescens	rock cress
Brassica nigra *	black mustard
Brassica tournefortii *	Sahara mustard
Caulanthus cooperi	jewelflower
Caulantus inflatus	desert candle
Descuriana pinnata	yellow tansy mustard
Descurainia sophia *	tansy mustard
Dithyrea californica	spectacle-pod
Draba cuneifolia	desert draba
Guillenia lasiophylla (=*Thelypodium lasiophyllus*)	guillenia
Lepidium flavum	yellow peppergrass
Lepidium fremontii	desert alyssum
Lepidium lasiocarpum *	hairy peppergrass
Sibara rosulata	sibara
Sisymbrium irio *	London rocket
Stanleya pinnata	Prince's plume
Streptanthella longirostris	streptanthella/twist flower

PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
CACTACEAE	**CACTUS FAMILY**
Echinocactus polycephalus var. *polycephalus*	old man cactus/cottontop cactus/clustered barrel
Echinocereus engelmannii	strawberry hedgehog
Mammillaria tetrancistra	nipple/fish-hook cactus
Opuntia basilaris var. *basilaris*	beavertail cactus
Opuntia echinocarpa	silver cholla/gold cholla
Opuntia ramosissima	pencil cactus/diamond cactus
Sclerocactus polyancistrus	Mojave pincushion cactus
CAMPANULACEAE	**BELLFLOWER FAMILY**
Nemocladus glanduliferus var. *orientalis*	sticky thread stem
Nemocladus rubesceus	yellow-flowered thread stem
Nemocladus sigmoideus	small yellow-flowered thread stem
CAPPARACEAE	**CAPER FAMILY**
Cleomella obtusifolia	Mojave stinkweed/blunt-leaf stinkweed
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**
Symphoricarpos longiflorus	snowberry
CARYOPHYLLACEAE	**PINK FAMILY**
Achyronychia cooperi	onyx flower/frost mat
Arenaria macradenia var. *macradenia*	desert sandwort
Spergularia marina *	sand spurrey
CHENOPODIACEAE	**GOOSEFOOT FAMILY**
Allenrolfea occidentalis	picklebush/iodine bush
Atriplex argentea var. *mohavensis*	Mojave saltbush
Atriplex canescens ssp. *canescens*	four-winged saltbush/wing-scale
Atriplex confertiflora	shadscale
Atriplex elegans ssp. *fasciculata*	wheelscale
Atriplex hymenelytra	desert holly
Atriplex lentiformis ssp. *lentiformis* (=*A.l.* ssp. *breweri*)	quailbush/big saltbush
Atriplex parryi	Parry saltbush
Atriplex phyllostegia	arrowscale
Atriplex polycarpa	cattle spinach/allscale
Atriplex spinifera	spinescale
Bassia hyssopifolia *	five-hook bassia
Grayia spinosa	spiny hop sage
Krascheninnikovia lanata (=*Eurotia lanata*)	winter fat
Kochia californica	gray molly
Monolepis nuttalliana	Nuttall's monolepis/patata
Nitrophila occidentalis	alkali pink
Salsola paulsenii *	barb-wire tumbleweed
Salsola tragus * (=*S. iberica*, *S. australis*, *S. kali*)	Russian thistle/tumbleweed
Suaeda moquinii (=*S. fruticosa*, *S. torreyana*)	bush seep weed/torrey inkweed/iodine weed
CUCURBITACEAE	**GOURD FAMILY**
Cucurbita palmata	coyote melon
CUSCUTACEAE	**DODDER FAMILY**
Cuscuta sp.	dodder
Cuscuta denticulata	toothed dodder

PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
EUPHORBIACEAE	**SPURGE FAMILY**
Chamaesyce sp.	prostrate spurge
Chamaesyce albomarginata	rattlesnake weed
Chamaesyce micromera (=*Euphorbia m.*)	desert spurge
Chamaesyce ocellata (=*Euphorbia o.*)	valley spurge/cinder sandmat
Chamaesyce polycarpa	small-seed sandmat
Croton californica var. *mohavensis*	Mojave croton
Stillingia spinulosa	broad-leaved stillingia
FABACEAE	**LEGUME FAMILY**
Acacia greggii	catclaw acacia
Astragalus sp.	milkvetch
Astragalus acutirostris	sharp keeled milkvetch/keel-beak
Astragalus didymocarpus var. *didymocarpus*	two-seeded milkvetch
Astragalus gambelianus	milkvetch
Astragalus jaegerianus (sensitive)	twining locoweed
Astragalus layneae	layne milkvetch
Astragalus lentiginosus var. *fremontii*	dapplepod
Astragalus lentiginosus var. *variabilis*	milkvetch/mottled locoweed
Astragalus mojavensis var. *mojavensis*	Mojave milkvetch
Astragalus purshii	Pursh's locoweed
Dalea mollis	slender silk dalea
Dalea mollissima	downy dalea
Lotus sp.	lotus/trefoil
Lotus strigosus (=*L. tomentellus*)	hairy lotus
Lupinus arizonicus	Arizona lupine
Lupinus concinnus	bajada/sand lupine
Lupinus excubitus var. *excubitus*	grape soda lupine
Lupinus magnificus var. *glarecola* (sensitive)	Coso Mountains lupine
Lupinus shockleyi	dune lupine/Shockley's lupine
Melilotus indicus *	alfalfa
FABACEAE (Continued)	**LEGUME FAMILY (Continued)**
Prosopis glandulosa var. *torreyana* (=*P. juliflora* var. *t.*)	mesquite/honey mesquite
Prosopis pubescens *	screwbean mesquite
Psorothamnus arborescens var. *arborescens*	silver indigo bush
Psorothamnus arborescens var. *minutifolius*	Mojave indigo bush
Psorothamnus fremontii (=*Dalea f.*)	smoke tree
Psorothamnus polydenius (=*Dalea p.*)	dotted dalea/Nevada indigobush
Senna armata (=*Cassia a.*)	spiny senna
FRANKENIACEAE	**FRANKENIA FAMILY**
Frankenia salina (F. grandiflora)	frankenia
GERANIACEAE	**GERANIUM FAMILY**
Erodium cicutarium *	red-stemmed filaree/storksbill/heron bill
Erodium texanum	storksbill/texas filaree

PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
HYDROPHYLLACEAE	**WATERLEAF FAMILY**
Emmenanthe penduliflora	whispering bells
Eucryta chrysanthemifolia var. *Bipinnatifida*	eucrypta
Eucrypta micrantha	dwarf eucrypta
Nama demissum	purple mat
Nama depressum	narrow-leaf nama
Nama pusillium	small-leaf nama
Phacelia calthifolia	caltha-leaf phacelia
Phacelia crenulata	sheltered phacelia
Phacelia cryptantha	purple phacelia/heliotrope phacelia
Phacelia distans	common phacelia/blue phacelia
Phacelia fremontii	yellow throats/phacelia
Phacelia neglecta	black alkali phacelia
Phacelia pachyphylla	thick-leaf phacelia
Phacelia parishii	Parish phacelia
Phacelia perityloides	pearl o'rock
Phacelia rotundifolia	round-leaved phacelia
Phacelia vallis-mortae	Death Valley phacelia
Tricardia watsonii	three hearts
KRAMERIACEAE	**KRAMERIA FAMILY**
Krameria erecta (=*K. parvifolia* var. *imparata*)	pima ratany/purple heather
LAMIACEAE	**MINT FAMILY**
Marrubium vulgare	horehound
Salazaria mexicana	bladder-sage
Salvia columbariae	chia
Salvia dorrii	gray ball sage
Salvia mohavensis	mojave sage
LENNOACEAE	**LENNOA FAMILY**
Pholisma arenarium	pholisma/scaly-stemmed sand plant
LOASACEAE	**LOASA FAMILY**
Eucnide urens	sting bush/rock nettle
Mentzelia albicaulis	blazing star/stickleaf
Mentzelia involucrata	white-bracted stickleaf
Mentzelia oreophila (=*M. puberula*)	rough-stemmed blazing star
Mentzelia reflexa	reflexed blazing star
Mentzelia tridentata	three-toothed blazing star
Petalonyx nitidus	sandpaper plant/petalonyx
Petalonyx thurberi ssp. *thurberi*	Thurber's common sandpaper plant/petalonyx
LYTHRACEAE	**LOOSESTRIFE FAMILY**
Lythrum californicum	California loosestrife
MALVACEAE	**MALLOW FAMILY**
Eremalche exilis	white mat mallow
Eremalche rotundifolia	desert five spot
Spheralcea ambigua	apricot mallow/desert mallow
NYCTAGINACEAE	**FOUR O'CLOCK FAMILY**
Abronia villosa var. *villosa*	desert sand verbena
Allionia incarnata	windmills/trailing four o'clock
Anulocaulis annulatus (=*Boerhaavia annulata*)	sticky ring/ringstem
Mirabilis bigelovii	desert four-o'clock wishbone
OLEACEAE	**OLIVE FAMILY**
Forestiera pubescens (=*F. neomexicana*)	desert olive
Menodora spinescens	spiny menodora

PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
ONAGRACEAE	**EVENING PRIMROSE FAMILY**
Camissonia boothii ssp. *desertorum*	woody bottle washer/sun cup
Camissonia brevipes	yellow cups
Camissonia campestris	Mojave sun cup/Inyo sun cups
Camissonia claviformis ssp. *claviformis*	brown-eyed evening primrose
Camissonia palmeri	Palmer evening primrose
Camissonia refracta	narrow-leaf evening primrose
Camissonia walkeri ssp. *torilis*	Walker's rock primrose
Oenothera caespitosa ssp. *marginata*	fragrant evening primrose
Oenothera deltoides	Devil's lantern/birdcage/ dune evening primrose
PAPAVERACEAE	**POPPY FAMILY**
Arctomecon merriamii (sensitive)	white bear poppy
Argemone munita ssp. *argentea*	Mojave prickly poppy
Argemone corymbosa	Silver leafy prickly poppy
Eschscholzia glyptosperma	desert poppy
Eschscholzia minutiflora	little gold poppy
PLANTAGINACEAE	**PLANTAIN FAMILY**
Plantago ovata (=*P. insularis*)	woolly plantain
Plantago sp.	plantain
POLEMONIACEAE	**PHLOX FAMILY**
Allophyllum gilioides	allophyllum
Eriastrum eremicum	desert woolly star
Eriastrum sapphirinum	sapphire flower
Eriastrum wilcoxii	Wilcox woolly star
Gilia sp.	gilia
Gilia cana	showy gilia
Gilia filiformis	thread-leaved gilia
Gilia latifolia	large-flowered gilia
Gilia transmontana	mountain gilia
Langloisia setosisima ssp. *punctata*	spotted langloisia
Leptodactylon pungens	granite gilia/prickly phlox
Linanthus arenicola (sensitive)	sand linanthus
Linanthus aureus	golden gilia
Linanthus bigelovii	desert snow
Linanthus demissus	dwarf linanthus/humble gilia
Linanthus dichotomus	evening snow
Linanthus jonesii	Jones' linanthus
Loeseliastrum matthewsii (=*Langloisia m.*)	desert calico
Loeseliastrum schottii (=*Langloisia s.*)	little sunbonnets

PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
POLYGONACEAE	**BUCKWHEAT FAMILY**
Centrostegia thurberi (=*Chorizanthe t.*)	Thurber's spineflower
Chorizanthe brevicornu	brittle spineflower
Chorizanthe corrugata	corrugate spineflower
Chorizanthe rigida	spiny herb/rosy-thorn
Eriogonum deflexum ssp. *deflexum*	skeleton weed/flat-topped buckwheat
Eriogonum fasciculatum var. *polifolium*	rosemary flat-top buckwheat/california buckwheat
Eriogonum gracillimum	slender eriogonum
Eriogonum heermannii	Heermann's buckwheat
Eriogonum inflatum	desert trumpet
Eriogonum maculatum	angle-stemmed eriogonum
Eriogonum microthecum	wild buckwheat
Eriogonum nidularium	bird's nest buckwheat
Eriogonum pusillum	yellow turban
Eriogonum reniforme	kidney-leaved buckwheat
Eriogonum rixfordii	Rixford's buckwheat
Eriogonum thomasii	Thomas' buckwheat
Eriogonum trichopes	little trumpet
Oxytheca perfoliata	saucer plant
Polygonum aviculare *	knotweed
Pterostegia drymarioides	pterostegia
PORTULACACEAE	**PURSLANE FAMILY**
Calandrinia ambigua	calandrinia
Calyptridium monandrum	common calyptridium/pussypaws
Claytonia parviflora ssp. *parviflora* (=*Montia perfoliata* var. *utahnesis*)	desert miner's lettuce
RANUNCULACEAE	**BUTTERCUP FAMILY**
Delphinium parishii ssp. *parishii*	Parish's larkspur/desert larkspur
RESEDACEAE	**MIGNONETTE FAMILY**
Oligomeris linifolia	oligomeris
ROSACEAE	**ROSE FAMILY**
Cercocarpus intricatus	little limestone mountain mahogany
Coleogyne ramossisima	blackbush
Prunus fasciculata	desert almond
RUBIACEAE	**MADDER FAMILY**
Galium sp.	bedstraw/cleavers
Galium stellatum var. *eremicum*	star bedstraw
RUTACEAE	**RUE FAMILY**
Thamnosma montana	terpentine-broom
SALICACEAE	**WILLOW FAMILY**
Populus fremontii	cottonwood
Salix sp.	willow
Salix exigua (=*S. hindsiana*)	narrow-leaf willow
Salix gooddingii	Gooding's black willow
SAURURACEAE	**LIZARD-TAIL FAMILY**
Anemopsis californica	yerba mansa

PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
SCROPHULARIACEAE	**FIGWORT FAMILY**
Antirrhinum filipes	antirrhinum/twining snapdragon
Castilleja angustifolia (=*C. chromosa*)	desert Indian paintbrush
Mimulus bigelovii var. *bigelovii*	Bigelow's monkey flower/Bigelow's mimulus
Mohavea breviflora	mohavea
Penstemon incertus	beardtongue
Penstemon palmeri var. *palmeri*	Palmer's penstemon
SOLANACEAE	**NIGHTSHADE FAMILY**
Lycium andersonii	box thorn/desert tomato
Lycium cooperi	peach thorn/box thorn
Nicotiana attenuata	coyote tobacco
Nicotiana obtusifolia (=*N. trignophylla*)	desert tobacco
Physalis crassifolia	ground cherry/thick-leaved ground cherry
TAMARICACEAE	**TAMARISK FAMILY**
Tamarix aphylla *	athel tree
Tamarix ramosissima *	salt cedar/tamarisk
VISCACEAE	**MISTLETOE FAMILY**
Phoradendron californicum	desert mistletoe/California mistletoe
Phoradendron densum	juniper mistletoe
ZYGOPHYLLACEAE	**CALTROP FAMILY**
Larrea tridentata	creosote bush
ANGIOSPERMS-MONOCOTS	
ARECACEAE	**PALM FAMILY**
Phoenix canariensis *	Canary Island date pal
Washingtonia californica	fan palm
CYPERACEAE	**SEDGE FAMILY**
Eleocharis rostellata	spike rush
Schoenus nigricans	
Scirpus americanus	trisquare
Scirpus pungens	bullrush/tule
Scirpus robustus	alkali bullrush
IRIDACEAE	**IRIS FAMILY**
Sisyrinchium bellum	blue-eyed grass
JUNCACEAE	**RUSH FAMILY**
Juncus sp.	rush
Juncus acutus	spiny rush
Juncus balticus (J. mexicanus)	wire grass
Juncus bufonius	toad rush
Juncus cooperi	Cooper rush
JUNCAGINACEAE	**ARROWGRASS FAMILY**
Triglochin concinnum var. *debile*	arrow grass
LILIACEAE	**LILY FAMILY**
Androstephium breviflorum (sensitive)	small-flowered androstephium
Calochortus flexuosus	strangling mariposa
Calochortus kennedyi	Kennedy's mariposa lily
Calochortus striatus	alkali mariposa lily
Dichelostemma capitatum (=*D. pulchella*)	blue dicks
Hesperocallis undulata	desert lily
Yucca brevifolia	Joshua tree
Yucca schidigera	Mojave yucca

PLANT SPECIES OBSERVED IN THE STUDY AREA

Scientific Name	Common Name
ORCHIDACEAE	**ORCHID FAMILY**
Epipactis gigantea	giant stream orchid
POACEAE	**GRASS FAMILY**
Achnatherum hymenoides (=*Oryzopsis h.*)	Indian mountain rice/Indian ricegrass
Achnatherum speciosum (=*Stipa speciosa*)	desert needlegrass
Aristida adscensionis	six-weeks three-awn
Aristida californica var. *californica*	California three-awn
Aristida purpurea var. *fendleriana*	purple three-awn/fendler three-awn
Aristida purpurea var. *nealleyi*	purple three-awn
Avena sp. *	oats
Bromus madritensis ssp. *rubens* * (=*B. rubens*)	red brome/foxtail chess
Bromus tectorum *	cheat grass
Bromus trinii *	Chilean chess
Cynadon dactylon *	Bermuda grass
Distichilis spicata	salt grass
Elymus elymoides (=*Sitanion hystrix*)	squirreltail
Erioneuron pulchellum	fluff grass
Hordeum murinum ssp. *glaucum* * (=*H. glaucum*)	wall/foxtail barley
Panicum urvilleanum	dune millet
Phragmites australis * (=*P. communis*)	common reed
Pleurophis rigida (=*Hilaria r.*)	big galleta grass
Poa secunda ssp. *secunda* (=*P. scabrella*)	one-sided bluegrass/pine bluegrass
Polypogon monspeliensis *	rabbit foot grass
Schismus arabicus *	Mediterranean grass
Schismus barbatus *	split grass
Sporobolus airoides	
Tridens muticus	alkali sacaton
Vulpia octoflora (=*Festuca o.*)	hairy six weeks fescue
TYPHACEAE	**CATTAIL FAMILY**
Typha sp.	cattail

*** indicates a nonnative species**

Sources

Sensitive Plant species Survey on a Portion of the Proposed Fort Irwin NTC Expansion Area, San Bernardino County, California.

Spring Sensitive Plant Species Field Surveys of the Fort Irwin National Training Center Proposed Silurian Valley Expansion Alternative, San Bernardino County, California.

Final Sensitive Plant Species Field Survey of Fort Irwin National Training Center Proposed Silurian Valley Expansion, San Bernardino County, California.

Nomenclature per Hickman 1993

APPENDIX E

GENERAL AIR CONFORMITY REQUIREMENTS STUDY

AV-R-95-02-241R2

FINAL REPORT

GENERAL CONFORMITY REQUIREMENTS LAND ACQUISITION PROJECT

FORT IRWIN NATIONAL TRAINING CENTER
FORT IRWIN, CALIFORNIA

Prepared for

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September 1996

EXECUTIVE SUMMARY

Fort Irwin is in the process of acquiring a large section of land from the Bureau of Land Management (BLM) and other entities. As a federal action, the land acquisition and subsequent operations were potentially subject to the General Conformity requirements of the Clean Air Act Amendments of 1990 (Title 1). This final report details the procedure that Fort Irwin National Training Center (Fort Irwin) has followed to address the General Conformity issue.

The US Environmental Protection Agency (EPA) issued a General Conformity Guidance in November 1993 with further clarification in July 1994. The document describes methods for federal agencies to follow to either demonstrate Conformity or to show that the federal action is exempt from the Conformity demonstration requirement.

Based on EPA guidance:

- The Fort Irwin land acquisition itself is exempt from Conformity requirements [§51.853(c)(2)(xx)].
- Operations occurring after the land acquisition are also exempt [§51.853(c)(1)].

Section §51.853(c)(1) exempts actions where the total of direct and indirect emissions are below the specified threshold—in this case 100 tons/year for PM-10. After calculating vehicle exhaust, fugitive dust caused by vehicle travel, and wind erosion-caused PM-10 emissions, it was concluded that the land acquisition action would not trigger the threshold. Therefore, the action is exempt from demonstrating Conformity. This report presents our calculations and conclusions.

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Section 1

INTRODUCTION

1.1 LEGISLATIVE BACKGROUND

The Clean Air Act (Act) requires EPA to promulgate rules to ensure that federal actions conform to the appropriate State Implementation Plan (SIP). These rules are codified in 40 CFR Parts 6, 51, and 93. Conformity is defined as being consistent with the SIPs purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards.

The federal agency responsible for the proposed action is required to determine if its actions conform to the applicable SIP. If the action involves the Federal Highway Administration or Federal Transit Authority, it falls under Transportation Conformity rules. All other federal actions, such as the Fort Irwin land acquisition project, fall under General Conformity rules.

In the case of Fort Irwin, Conformity with the SIP demonstrates that the land acquisition project will not impede the progress of the Mojave Desert Air Quality Management District's (MDAQMD) plan to achieve ozone or PM-10 attainment. In the attainment areas, it is not necessary to demonstrate Conformity unless the area is within 85 percent of the NAAQS or designated as a "maintenance area." In discussions with MDAQMD at a public hearing on their new Conformity rules, MDAQMD stated that there were no designated "maintenance areas" in their jurisdiction. Therefore, only PM-10 emissions were of concern, because all current and future activities take place in the ozone attainment, PM-10 nonattainment area. With respect to ozone attainment, the area proposed for acquisition is in an area designated as attainment for ozone. Thus, ozone issues are not addressed in this Conformity Determination.

A recent lawsuit by environmental groups is attempting to force EPA to promulgate rules that would also bring attainment areas under Conformity guidelines. It is not expected that this will impact Fort Irwin unless the suit is resolved in the immediate future.

The MDAQMD has submitted a request to the California Air Resources Board (ARB) proposing that the area east of the urbanized high desert be redesignated as "unclassified" for PM-10. This area includes Fort Irwin National Training Center and Twenty-nine Palms Marine Corps Air Ground Combat Center (MCAGCC). The redesignation would allow the MDAQMD to focus on reducing anthropogenic and urban sources within their jurisdiction. No action has been taken by ARB at this time. Therefore, Fort Irwin remains as moderate in an area designated PM-10 nonattainment area.

Exclusion of the two large military bases from the nonattainment area is contingent upon two actions: (1) perimeter PM-10 monitoring around each facility to demonstrate that each facility does not cause or contribute to NAAQS exceedances, and (2) coarse PM-10 dispersion modeling to demonstrate that each facility cannot cause or contribute to PM-10 NAAQS exceedances under worst-case meteorological conditions.

PM-10 monitoring is ongoing at Fort Irwin. A monitoring network began operating in October 1994 with three sites (central, southern, and western) to be supplemented by several northern and eastern sites as technical difficulties are overcome. Twenty-nine Palms has submitted a draft PM-10 monitoring work plan to both the MDAQMD and ARB for review and comment. It is evident that the military already has and will commit to PM-10 monitoring to document representative actual PM-10 concentrations at their facility boundaries (MDAQMD, PM-10 Attainment Plan, 1995).

1.2 DESCRIPTION OF OPERATIONS

(AVES has worked with military staff at Fort Irwin to determine the order of magnitude change in emissions of current versus post-land acquisition activities. The Army conducts a 15-day rotational training schedule; typically, twelve times throughout the year. This training schedule includes tracked and wheeled vehicles and armored and mechanized forces.

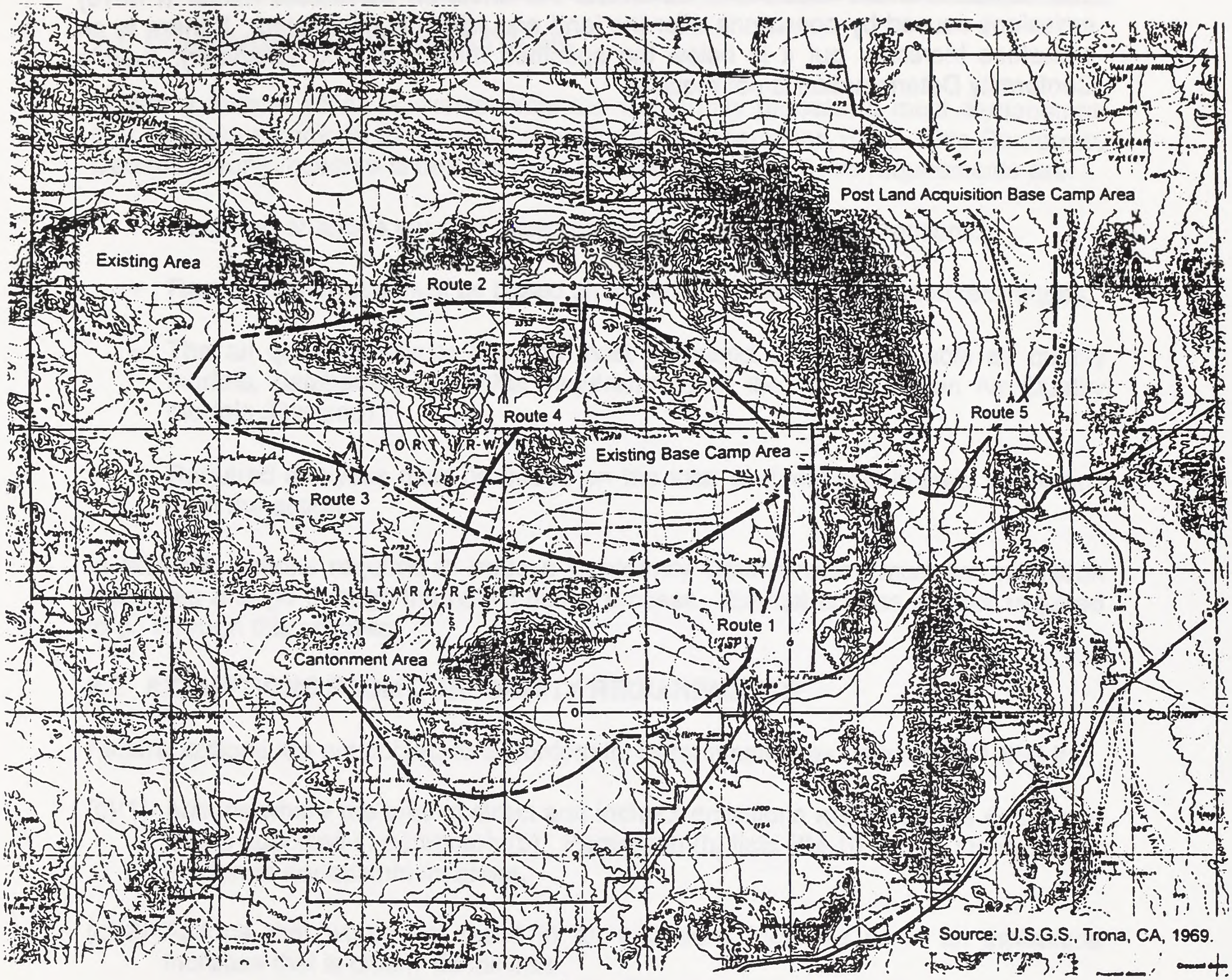
- **Existing Operations**

Under existing operations, the 15-day rotation is split between force-on-force operations (nine days) and live-fire operations (five days). Operations are on a "brigade" level.

These operations are initiated at the cantonment area and operated in an area in the approximate center of the reservation (see Figure 1-1). Supply convoys travel back and forth to the cantonment area periodically throughout the rotational schedule for supplies.

- **Land Acquisition Operations**

Under the land acquisition, brigade operations will take place all 14 days with force-on-force occurring on days 0 to 8 and live-fire on days 9 to 14. Repeated trips to the cantonment area will be eliminated by establishing the Division Support Area (base camp) in the vicinity of the rotational activity instead of the cantonment area, as is currently done.



Source: U.S.G.S., Trona, CA, 1969.

FIGURE 1-1. Existing and post-land acquisition area and routes.

1.3 REPORT OBJECTIVES

The objective of this report is to determine the effect on particulate matter (PM-10) emissions caused by operations after the land acquisition is completed. If there is an emissions increase, but it is below the specified threshold (100 tons/year), then a Conformity Determination is not required.

Section 2

GENERAL CONFORMITY REQUIREMENTS

2.1 CONFORMITY DEMONSTRATIONS

Unless a federal action is exempt from the Conformity process, it must demonstrate that its actions conform to the applicable State Implementation Plan. This Conformity Determination procedure is detailed in 51.859 (40 CFR Part 51) its requirements are:

- Required analyses must be based on the latest planning assumptions.
- Required analyses must be based on the latest emission estimation techniques.
- The air quality analyses required must be based on the applicable air quality models, databases, and other requirements of the "Guideline on Air Quality Models (Revised)."
- Required analyses must be based on the total of direct and indirect emissions from the action.

In addition, actions required to issue a Conformity Determination must list mitigation measures and go through the public notice process. Exempt actions are not required to go through this process.

2.2 EXEMPTIONS FROM CONFORMITY REQUIREMENTS

Federal actions are not subject to a Conformity Determination as defined in 51.853 if:

(c)(1) Actions where the total of direct and indirect emissions are below the emissions levels specified in paragraph (b). Paragraph (b) lists PM-10 at 100 tons/year for moderate nonattainment areas.

(c)(2) Actions that would not result in an emissions increase or in an emissions increase that is clearly de minimis.

These types of exempt actions are:

- Transfers of real property from one federal entity to another.
- Routine operation of facilities, mobile assets, and equipment.
- Continuing and recurring activities where such activities will be similar in scope and operation to activities currently being conducted.

- Projects subject to nonattainment new source review (NSR) or prevention of significant deterioration (PSD).

- Below certain threshold levels.

Even though these exemptions exist and apply to Fort Irwin (e.g., land transfer, continuing and recurring activities, routine operation of facilities), EPA has the authority to evaluate whether the activity should indeed be exempt. Therefore, it was the strategy of this report's writers to proceed as if there were no exemptions and determine if the actual emissions increase (if any) was de minimis.

Section 3

EMISSION CALCULATIONS

3.1 METHODOLOGY

The methodology for our emission calculations and analysis is divided among the three areas that generate PM-10 emissions. These areas include vehicle miles traveled (VMT) of equipment (e.g., tanks, trucks, etc.) over desert surfaces for the purpose of military training and maneuvering, exhaust emissions associated with this travel, and wind erosion of those disturbed desert surfaces. Within each of these three discussions are described:

- The calculation methods.
- The total calculated emissions.
- The impact of these emissions relative to the Conformity Determination threshold.
- A comparison between existing deployment activities and post-land acquisition activities.

Indirect emissions were not calculated because there will be no increase in equipment or personnel after the land acquisition. In addition, aviation emissions were not calculated. No change in takeoffs, landings, or number of planes would occur under post-land acquisition.

3.2 VEHICLE FUGITIVE DUST PM-10 EMISSIONS

The post-land acquisition area currently belongs to the Bureau of Land Management (BLM). The current condition of the lands proposed for acquisition are likely disturbed, based on text contained in the MDAQMD PM-10 Attainment Plan. According to discussions pertaining to emissions inventory sources in the plan, vehicle activity on BLM lands in 1990 generated 10 percent of the PM-10 emissions for the MDAQMD planning area total. This category represents dust generated by vehicle travel on BLM lands, including casual vehicle use and specific vehicle use, such as races and off-highway vehicles (OHV) area use. The BLM maintains several large OHV areas within the planning area, which cover 582 square miles. Activity on BLM lands is forecasted to increase proportionally with the planning area population (MDAQMD, PM-10 Attainment Plan, 1995).

Vehicles traveling over paved and unpaved surfaces represent a substantial contribution to PM-10 emissions at Fort Irwin. The first step in the process was to estimate the vehicle miles traveled (VMT) per rotation. This was done by going route by route, segment by segment, each day of a typical rotation to determine speed and

VMT for each vehicle type. VMT, along with vehicle speed, weight, number of wheels (or tracks), silt content and the number of rainy days per year was then used to calculate PM-10 emissions per rotation. Approximately 70 spreadsheets were generated to perform the required calculations and are presented in Appendix A.

PM-10 emissions per rotation for existing conditions were then compared to post-land acquisition emissions and multiplied by the number of rotations per year (12) to get the difference in yearly emissions.

Existing Operations

The travel routes currently used for deployment activities are illustrated on Figure 1-1. Deployment activities generally follow Route 1 and set up a base camp located at the intersection between Route 1 and Route 3. This base camp is approximately 20 square kilometers. From this base camp, deployment activities would branch out and extend generally along the routes outlined on Figure 1-1. BLUFOR and OPFOR operations can travel anywhere in this area except those areas that are off-limits to military maneuvers, which include dry lake beds, slopes greater than 20 percent, and areas occupied by endangered habitats.

Existing total VMT (sum of BLUFOR and OPFOR) during deployment activities are 311,258 per 15-day rotation. VMT per day for an existing rotation are illustrated in Table 3-1.

To calculate the fugitive emissions associated with travel during deployment activity, AVES used the tables in the South Coast Air Quality Management District's CEQA Handbook which are contained in EPA's AP-42. Tables used included Table A9-9-C (Estimating Emissions From Travel on Paved Roads), and Table A9-9-D (Estimating Emissions From Vehicle Travel on Unpaved Roads). Silt loading from unpaved roads were derived from actual surveys in which sieve samples were collected. These samples indicate silt contents ranging from 6 to 7 percent. AVES used 6.5 percent in our calculations. For paved roads, we assumed silt loading would be approximately 0.214 lb/VMT (trucks on local roads), based on guidelines contained in the CEQA Handbook (Table A9-9-C-1).

Total emissions from existing maneuvering activities is illustrated in Table 3-2. For a more detailed explanation of emissions per day per type of equipment, refer to Appendix A. The existing rotation (sum of BLUFOR and OPFOR) generates 409,292 pounds per rotation, or 204.6 tons per rotation.

Post-land acquisition Operations

The travel routes proposed for post-land acquisition activities are illustrated on Figure 1-1. Deployment activities will start out in the cantonment area as before. The primary difference with post-land acquisition activities would be the establishment of the base camp on the acquired land which would eliminate unnecessary trips back to the cantonment area—thus reducing VMT. From this new base camp, deployment activities would branch out in the same fashion as under existing conditions.

TABLE 3-1. Existing Vehicle Miles Traveled (VMT).

Day	BLUFOR, VMT	OPFOR, VMT
Day 0	51466	0
Day 0-1	2160	0
Day 1	7869	0
Day 2	9318	0
Day 3	4370	0
Day 4	10742	0
Day 5	14862	0
Day 6	13804	0
Day 7	26721	16280
Day 8	18778	7676
Day 9	8840	7180
Day 10	8462	2638
Day 11	11684	7398
Day 12	9746	3159
Day 13	12836	6782
Day 14	38419	10068
Rotation Total	**250077 VMT**	**61181 VMT**

TABLE 3-2. Existing Daily Emissions From BLUFOR and OPFOR Activities.

Day	BLUFOR, lbs PM-10	OPFOR, lbs PM-10
Day 0	70306	0
Day 0-1	3430	0
Day 1	13979	0
Day 2	18704	0
Day 3	5962	0
Day 4	20710	0
Day 5	23931	0
Day 6	19895	0
Day 7	23145	22678
Day 8	29899	13539
Day 9	7496	12048
Day 10	6990	4075
Day 11	13248	14210
Day 12	9091	4768
Day 13	15801	11768
Day 14	33680	9939
Rotation Totals	**316267 lbs**	**93025 lbs**

Post-land acquisition VMT per rotation (sum of BLUFOR and OPFOR) would be 285,171. VMT per day are illustrated in Table 3-3.

TABLE 3-3. Post-land Acquisition Vehicle Miles Traveled (VMT)

Day	BLUFOR, VMT	OPFOR, VMT
Day 0	63055	0
Day 0-1	2811	0
Day 1	14397	0
Day 2	3672	0
Day 3	4188	0
Day 4	7364	0
Day 5	8684	0
Day 6	16582	0
Day 7	3712	14999
Day 8	9320	2236
Day 9	7384	2386
Day 10	14456	4638
Day 11	6648	1270
Day 12	5804	4828
Day 13	14644	2702
Day 14	60655	8736
Rotation Totals	**243376 VMT**	**41795 VMT**

To calculate the fugitive dust emissions associated with travel during military maneuvering, AVES used the tables in the SCAQMD CEQA Handbook. Tables used included Table A9-9-C, Estimating Emissions From Travel on Paved Roads and Table A9-9-D, Estimating Emissions From Vehicle Travel on Unpaved Roads. The same silt values were used as in the "existing" emission calculations.

Total emissions from post-land acquisition maneuvering activities is illustrated in Table 3-4. For a more detailed explanation of emissions per day (per rotation) per type of equipment, refer to Appendix A.

The post-land acquisition rotation would generate 375,862 pounds, or 187.9 tons per rotation. The 187.9 tons per rotation is less than existing conditions by 16.7 tons per rotation or 200 tons per year (12 rotations). Therefore, the post-land acquisition action would result in a fugitive dust PM-10 emission benefit by generating 200 tons/year less VMT emissions than under existing operations. It should be noted that no credit was calculated for displacing fugitive dust PM-10 emissions on existing BLM land from OHV use.

TABLE 3-4. Post-land Acquisition Emissions From BLUFOR and OPFOR Activities.

Day	BLUFOR, lbs PM-10	OPFOR, lbs PM-10
Day 0	69844	0
Day 0-1	3378	0
Day 1	24805	0
Day 2	4106	0
Day 3	4768	0
Day 4	13449	0
Day 5	16409	0
Day 6	30102	0
Day 7	3949	23846
Day 8	17167	2066
Day 9	8678	2602
Day 10	23392	5731
Day 11	7802	623
Day 12	6479	1385
Day 13	21580	5520
Day 14	57316	20865
Rotation Totals	**313224 lbs**	**62638 lbs**

3.3 VEHICLE TAILPIPE PM-10 EMISSIONS

Internal combustion engines produce PM-10 emissions as part of the combustion process. This is especially true of diesel engines. In the case of Fort Irwin, vehicle exhaust PM-10 emissions are much lower in relative magnitude than VMT fugitive dust emissions. However, it is still important to understand their contribution.

Exhaust PM-10 emissions are dependent primarily on VMT for calculation purposes. Therefore, VMT results from the fugitive dust VMT exercise were used in the exhaust PM-10 calculations.

Existing Operations

PM-10 exhaust emissions for existing operations were calculated using the SCAQMD CEQA Handbook, Table A9-5, Estimating Emissions from On-Road Vehicle Travel (pounds per day); and Table A9-5-K-3, EMFAC7EP Emission Factors for SCAQMD, Vehicles with Gross Vehicle Weight 6001 Pounds and Up, Calendar Year 1997. Existing PM-10 exhaust emissions would be 0.17 tons per rotation, or 2.04 tons/year.

Post-land acquisition Operations

PM-10 exhaust emissions for post-land acquisition operations were calculated using (1) the SCAQMD CEQA Handbook, Table A9-5, Estimating Emissions from On-Road Vehicle Travel (pounds per day); and (2) Table A9-5-K-4, EMFAC7EP Emission

Factors for SCAQMD, Vehicles with Gross Vehicle Weight 6001 Pounds and Up, Calendar Year 1997. Post-land acquisition PM-10 exhaust emissions would be 0.16 tons per rotation, or 1.92 tons/year.

On a per-rotation basis, existing operations are 0.01 tons more PM-10 emissions than the post-land acquisition operations, or 0.12 tons/year (12 rotations). Therefore, the post-land acquisition action would result in a vehicle exhaust PM-10 emission benefit by generating 0.12 tons/year less VMT emissions than under existing operations.

3.4 WIND EROSION PM-10 EMISSIONS

Significant fugitive dust PM-10 emissions are generated by gusts of wind passing over disturbed desert areas. Various methods exist for calculating these emissions and are described in references such as EPA's *AP-42*, EPA's *Control of Open Fugitive Dust Sources*, EPA's *Fugitive Dust Background Document and Technical Informational Document for Best Available Control Measures*, and others. Typical parameters include type of soil, silt content, evapo-transpiration ratio, surface roughness, surface area, wind speed and frequency over a threshold velocity, frequency of disturbance, and erosion potential.

A quantitative estimate of the difference in wind erosion PM-10 emissions between existing and post-land acquisition operations is difficult for many reasons (estimating disturbed surface area, frequency of disturbance, etc.). Therefore, the following is a qualitative discussion and comparison of wind erosion PM-10 emissions for existing versus post-land acquisition operations.

At Fort Irwin, nonhomogeneous surfaces impregnated with nonerodible elements (stones, vegetation) are characterized by the limited reservoir of erodible material. Such surfaces have high threshold wind speeds for wind erosion, and particulate emission rates tend to decay rapidly during an erosion event. The Fort Irwin region is subject to wind speeds that often exceed 30 miles per hour. Although the desert surface in the confines of Fort Irwin is characterized by nonhomogeneous surfaces, it is substantially disturbed. Disturbance caused by military maneuvering has generated aeolian erosion and subsequently high PM-10 levels within the confines of Fort Irwin.

Emissions generated by wind erosion are also dependent on the frequency of disturbance. Each time a surface is disturbed, its erosion potential is restored. A disturbance is defined as an action which results in the exposure of fresh material. Because the region is nonhomogeneous, it was assumed that one substantial gust would deplete the majority of the "limited reservoir" of erodible material. Thus, this area would be "stabilized" until the next disturbance.

Existing Operations

BLM unpaved wind erosion is a significant windblown fugitive dust category, generating two percent of the total planning area inventory and remaining levels through the year

2000. This category comprises the emissions from wind erosion of unpaved roads on BLM (and state) property. The vast majority of these roads lie in unpopulated areas north and east of the MDAQMD planning area (MDAQMD, PM-10 Attainment Plan, 1995).

Under existing conditions, the land acquisition area is disturbed by OHV activities and would account for part of the PM-10 wind erosion emissions produced by BLM lands. The degree of disturbance created by OHV activities is unknown and whether there would be a substantial increase by Fort Irwin equipment after the land acquisition. No Fort Irwin combat maneuvers would take place in the land acquisition area; this area is to be used only for staging and support camps.

Post-land acquisition Operations

Under post-land acquisition operations, the BLM OHV activities would cease and this land would eventually return to its natural state. However, military staging and support camps would now cause soil disturbance that would cause PM-10 erosion emissions during wind gusts.

The areas used under existing operations for staging and support camps would generally be abandoned after the land acquisition and actively revegetated. Fort Irwin has instituted a program in which areas that are not frequently used are revegetated with native plants. These areas are watered regularly. Under these conditions, the revegetated areas grow much faster than under normal desert conditions.

The existing Fort Irwin reservation has a significant amount of soil disturbance. While the available amount of land for military activities would increase as a result of the land acquisition, the total disturbed area is likely to remain approximately equivalent because the total number of vehicles would remain the same and the VMT would actually decrease.

To summarize, the total amount of disturbed area, via military activities, at any given time will not vary substantially and will possibly be less because of the stoppage of BLM OHV activities. Therefore, qualitatively, the difference in wind erosion PM-10 emissions between existing and post-land acquisition operations would be close to zero.

3.5 EMISSION CALCULATION SUMMARY

Table 3-5 presents a summary of emission calculations for fugitive dust vehicle PM-10, vehicle tailpipe PM-10 and wind erosion PM-10 for existing and post-land acquisition operations.

TABLE 3-5. Emission Summary - Tons PM-10 Per Year

Type of Emission	Existing Operations	Post-land acq. Operations	PM-10 Emission Difference
Vehicle Fugitive Dust	2455	2255	(200)
Vehicle Exhaust	2.04	1.92	0.12
Wind Erosion	--	--	0.0
Totals	**2457**	**2257**	**(200)**

Section 4

CONCLUSIONS

The land acquisition itself is exempt from the Conformity demonstration process. However, operations after land acquisition were not so clear-cut and were treated as if Conformity must be shown. By calculating the difference in emissions before and after the land acquisition process, this report shows that de minimis level of emissions would not be exceeded. Further, this report shows that there would be an emissions decrease caused by the decrease in vehicle miles traveled (VMT).

This decrease in VMT is not an intuitive conclusion given that more area would be available for travel after the land expansion. However, this is indeed the case because there is a radical change in operations made possible by removing the existing limitation to the operational area. Many of the trips back and forth from the existing maneuver area to the cantonment would be eliminated under the proposed operations scenario. A more in-depth understanding of the change in VMT can be gained by studying the summary spreadsheets first and then the daily spreadsheets (Appendix A).

In conclusion, there would be a decrease in PM-10 emissions as a result of the proposed action. Therefore, the action is exempt from the requirement to prepare a conformity determination.

Appendix A

WORKSHEETS

PM-10 EXHAUST AND TIRE WEAR EMISSIONS (LBS/VEHICLE PER ROTATION)

BLUFOR Existing	VMT/ROT.	PM-10	
Tracked (M1A1)	9637	10.83	
Tracked (M2AO)	9637	10.83	
Tracked (M113 FOV)	21777	24.46	
Tracked (M109)	1872	2.10	
Tracked (M578/M88)	7750	8.71	
Tracked (Eng. Equip.)	860	0.97	
Wheeled (M998)	83932	94.28	
Wheeled (2.5 ton)	42394	47.62	
Wheeled (5 ton)	26590	29.87	
Wheeled (HEMTT)	21748	24.43	
Tractor (10 ton)	23880	26.83	
Total	**250077**	**280.92**	lbs/rot.
Tons		**0.14**	tons

BLUFOR Post	VMT/ROT.	PM-10	
Tracked (M1A1)	11963	13.44	
Tracked (M2AO)	11963	13.44	
Tracked (M113 FOV)	29225	32.83	
Tracked (M109)	2052	2.31	
Tracked (M578/M88)	3820	4.29	
Tracked (Eng. Equip.	2895	3.25	
Wheeled (M998)	82268	92.42	
Wheeled (2.5 ton)	34506	38.76	
Wheeled (5 ton)	21508	24.16	
Wheeled (HEMTT)	32796	36.84	
Tractor (10 ton)	10380	11.66	
Total	**243376**	**273.40**	lbs/rot.
Tons		**0.14**	tons

OPFOR Existing	VMT/ROT.	PM-10	
Tracked (M551)	22218	24.96	
Tracked (M113 FOV)	3177	3.57	
Tracked (M578/M88)	2342	2.63	
Tracked (Eng. Equip.)	1150	1.29	
Wheeled (M998)	19014	21.36	
Wheeled (5 ton)	4980	5.59	
Wheeled (HEMTT)	3180	3.57	
Wheeled (M818)	5120	5.75	
Total	**61181**	**68.73**	lbs/day
Tons		**0.03**	tons

OPFOR Post	VMT/ROT.	PM-10	
Tracked (M551)	14508	16.30	
Tracked (M113 FOV)	2172	2.44	
Tracked (M578/M88)	534	0.60	
Tracked (Eng. Equip.	991	1.11	
Wheeled (M998)	13826	15.53	
Wheeled (5 ton)	3840	4.31	
Wheeled (HEMTT)	2520	2.83	
Wheeled (M818)	3404	3.82	
Total	**41795**	**46.95**	lbs/day
Tons		**0.02**	tons

***Used SCAQMD PM-10 exhaust equation,**
Table A9-5, "Estimation Emissions from On-Road Vehicle Travel (Pounds Per Day)."

***Also used Table A9-5-K-4, "EMFAC7EP Emission Factors for SCAQMD,**
Vehicles with Gross Vehicle Weight 6001 Pounds and Up, Calender Year 1997."

OPFOR POST LAND AQUISITION EMISSIONS AND VMT TOTALS

Total Emissions in Pounds

Vehicle Type	Day 0-6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Totals
Tracked (M551)	0	14376	471	941	3693	0	0	290	15450	**35221**
Tracked (M113 FOV)	0	1713	10	19	578	0	0	6	1893	**4219**
Tracked (Eng. Equip.)	0	356	67	135	201	0	0	41	0	**800**
Tracked (578/M88)	0	1706	40	80	209	0	0	25	2132	**4192**
Wheeled (M998)	0	2072	183	132	412	59	560	384	1390	**5192**
Wheeled (5 Ton)	0	1333	645	645	272	265	416	2717	0	**6293**
Wheeled (HEMTT)	0	979	513	513	239	162	258	2057	0	**4721**
Wheeled (M818)	0	1311	137	137	127	137	151	0	0	**2000**
Totals	**0**	**23846**	**2066**	**2602**	**5731**	**623**	**1385**	**5520**	**20865**	**62638**

Total VMT

Vehicle Type	Day 0-6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Totals
Tracked (M551)	0	6474	234	468	2106	0	0	234	4992	**14508**
Tracked (M113 FOV)	0	966	6	12	414	0	0	6	768	**2172**
Tracked (Eng. Equip.)	0	222	42	84	144	0	0	42	0	**534**
Tracked (578/M88)	0	455	12	24	72	0	0	12	416	**991**
Wheeled (M998)	0	5188	588	444	1356	270	2612	808	2560	**13826**
Wheeled (5 Ton)	0	628	420	420	240	234	938	960	0	**3840**
Wheeled (HEMTT)	0	406	294	294	186	126	574	640	0	**2520**
Wheeled (M818)	0	660	640	640	120	640	704	0	0	**3404**
Totals	**0**	**14999**	**2236**	**2386**	**4638**	**1270**	**4828**	**2702**	**8736**	**41795**

OPFOR POST LAND ACQUISITION - VMT

Road Type Category	Paved	Desert/Hard Packed	**Totals**
Silt Content	28	6.5	
Day 0 VMT	0	0	**0**
Day 0-1 VMT	0	0	**0**
Day 1 VMT	0	0	**0**
Day 2 VMT	0	0	**0**
Day 3 VMT	0	0	**0**
Day 4 VMT	0	0	**0**
Day 5 VMT	0	0	**0**
Day 6 VMT	0	0	**0**
Day 7 VMT	0	14999	**14999**
Day 8 VMT	640	1596	**2236**
Day 9 VMT	640	1746	**2386**
Day 10 VMT	0	4638	**4638**
Day 11 VMT	640	630	**1270**
Day 12 VMT	4288	540	**4828**
Day 13 VMT	0	2702	**2702**
Day 14 VMT	0	8736	**8736**
Totals	6208	35587	**41795**

Day 0-6

						PM-10 Totals	VMT
Mileage (miles)	0	0	0	0	0		
Speed (mph)	0	0	0	0	0		
Silt Content (%)	0	0	0	0	0		
Tracked (M551)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Tracked (M578/M88)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Tracked (Eng. Equip.)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (M998)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (5 ton)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (HEMTT)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (M818)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Total Emissions, lbs	0	0	0	0	0	0	
Total VMT, miles	0	0	0	0	0		0

Day 7

Day 7 - OPFOR							
Route	A to DD	DD to G	DD to H	H to I	I to J		
Mileage (miles)	25	4	3	12	6		
Speed (mph)	15	15	15	13	13	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M551)	9053	0	1086	3766	471	14376	
Vehicle Trips	156	0	156	156	39		
VMT	3900	0	468	1872	234		6474
Tracked (M113) FOV	1109	0	133	461	10	1713	
Vehicle Trips	24	0	24	24	1		
VMT	600	0	72	288	6		966
Tracked (Eng. Equip.)	0	0	0	288	67	356	
Vehicle Trips	0	0	0	15	7		
VMT	0	0	0	180	42		222
Tracked (M578/M88)	1249	108	69	240	40	1706	
Vehicle Trips	13	7	6	6	2		
VMT	325	28	18	72	12		455
Wheeled (M998)	1588	124	98	203	59	2072	
Vehicle Trips	156	76	80	48	28		
VMT	3900	304	240	576	168		5188
Wheeled (5 ton)	1168	102	64	0	0	1333	
Vehicle Trips	22	12	10	0	0		
VMT	550	48	30	0	0		628
Wheeled (HEMTT)	844	135	0	0	0	979	
Vehicle Trips	14	14	0	0	0		
VMT	350	56	0	0	0		406
Wheeled (M818)	1092	87	131	0	0	1311	
Vehicle Trips	22	11	22	0	0		
VMT	550	44	66	0	0		660
Total Emissions, lbs	16102	556	1581	4959	647	**23844**	
Total VMT, miles	10175	480	894	2988	462		**14999**

Day 8

Day 8 - OPFOR						
Route	G to H	H to I	J to I	G to A		
Mileage (miles)	9	12	6	32		
Speed (mph)	8	13	13	35	**PM-10 Totals**	**VMT**
Silt Content (%)	6.5	6.5	6.5	28		
Tracked (M551)	0	0	471	0	471	
Vehicle Trips	0	0	39	0		
VMT	0	0	234	0		234
Tracked (M113) FOV	0	0	10	0	10	
Vehicle Trips	0	0	1	0		
VMT	0	0	6	0		6
Tracked (Eng. Equip.)	0	0	67	0	67	
Vehicle Trips	0	0	7	0		
VMT	0	0	42	0		42
Tracked (M578/M88)	0	0	40	0	40	
Vehicle Trips	0	0	2	0		
VMT	0	0	12	0		12
Wheeled (M998)	39	85	59	0	183	
Vehicle Trips	20	20	28	0		
VMT	180	240	168	0		588
Wheeled (5 ton)	204	442	0	0	645	
Vehicle Trips	20	20	0	0		
VMT	180	240	0	0		420
Wheeled (HEMTT)	162	351	0	0	513	
Vehicle Trips	14	14	0	0		
VMT	126	168	0	0		294
Wheeled (M818)	0	0	0	137	137	
Vehicle Trips	0	0	0	20		
VMT	0	0	0	640		640
Total Emissions, lbs	405	877	647	137	**2066**	
Total VMT, miles	486	648	462	640		**2236**

Day 9

Day 9 - OPFOR						
Route	G to H	H to I	I to H	G to A		
Mileage (miles)	9	12	12	32		
Speed (mph)	8	13	13	35	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	28	**Totals**	**VMT**
Tracked (M551)	0	0	941	0	941	
Vehicle Trips	0	0	39	0		
VMT	0	0	468	0		468
Tracked (M113) FOV	0	0	19	0	19	
Vehicle Trips	0	0	1	0		
VMT	0	0	12	0		12
Tracked (Eng. Equip.)	0	0	135	0	135	
Vehicle Trips	0	0	7	0		
VMT	0	0	84	0		84
Tracked (M578/M88)	0	0	80	0	80	
Vehicle Trips	0	0	2	0		
VMT	0	0	24	0		24
Wheeled (M998)	39	85	8	0	132	
Vehicle Trips	20	20	2	0		
VMT	180	240	24	0		444
Wheeled (5 ton)	204	442	0	0	645	
Vehicle Trips	20	20	0	0		
VMT	180	240	0	0		420
Wheeled (HEMTT)	162	351	0	0	513	
Vehicle Trips	14	14	0	0		
VMT	126	168	0	0		294
Wheeled (M818)	0	0	0	137	137	
Vehicle Trips	0	0	0	20		
VMT	0	0	0	640		640
Total Emissions, lbs	405	877	1184	137	**2603**	
Total VMT, miles	486	648	612	640		**2386**

Day 10

Day 10 - OPFOR						
Route	G to H	H to I	I to H	H to F		
Mileage (miles)	9	12	12	6		
Speed (mph)	8	13	13	8	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M551)	0	0	2824	869	3693	
Vehicle Trips	0	0	117	117		
VMT	0	0	1404	702		2106
Tracked (M113) FOV	0	0	442	136	578	
Vehicle Trips	0	0	23	23		
VMT	0	0	276	138		414
Tracked (Eng. Equip.)	0	0	154	47	201	
Vehicle Trips	0	0	8	8		
VMT	0	0	96	48		144
Tracked (M578/M88)	0	0	160	49	209	
Vehicle Trips	0	0	4	4		
VMT	0	0	48	24		72
Wheeled (M998)	39	85	220	68	412	
Vehicle Trips	20	20	52	52		
VMT	180	240	624	312		1356
Wheeled (5 ton)	204	0	0	68	272	
Vehicle Trips	20	0	0	10		
VMT	180	0	0	60		240
Wheeled (HEMTT)	162	0	0	77	239	
Vehicle Trips	14	0	0	10		
VMT	126	0	0	60		186
Wheeled (M818)	0	0	0	127	127	
Vehicle Trips	0	0	0	20		
VMT	0	0	0	120		120
Total Emissions, lbs	405	85	3800	1442	**5731**	
Total VMT, miles	486	240	2448	1464		**4638**

Day 11

Day 11 - OPFOR					
Route	G to H	G to F	G to A		
Mileage (miles)	9	9	32		
Speed (mph)	8	8	35	**PM-10**	
Silt Content (%)	6.5	6.5	28	**Totals**	**VMT**
Tracked (M551)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M113) FOV	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (Eng. Equip.)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M578/M88)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Wheeled (M998)	20	39	0	59	
Vehicle Trips	10	20	0		
VMT	90	180	0		270
Wheeled (5 ton)	61	204	0	265	
Vehicle Trips	6	20	0		
VMT	54	180	0		234
Wheeled (HEMTT)	46	116	0	162	
Vehicle Trips	4	10	0		
VMT	36	90	0		126
Wheeled (M818)	0	0	137	137	
Vehicle Trips	0	0	20		
VMT	0	0	640		640
Total Emissions, lbs	127	359	137	**623**	
Total VMT, miles	180	450	640		**1270**

Day 12

Day 12 - OPFOR					
Route	G to F	G to H	G to A		
Mileage (miles)	9	9	32		
Speed (mph)	8	8	35	**PM-10**	
Silt Content (%)	6.5	6.5	28	**Totals**	**VMT**
Tracked (M551)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M113) FOV	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (Eng. Equip.)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M578/M88)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Wheeled (M998)	20	20	520	560	
Vehicle Trips	10	10	76		
VMT	90	90	2432		2612
Wheeled (5 ton)	61	204	151	416	
Vehicle Trips	6	20	22		
VMT	54	180	704		938
Wheeled (HEMTT)	46	116	96	258	
Vehicle Trips	4	10	14		
VMT	36	90	448		574
Wheeled (M818)	0	0	151	151	
Vehicle Trips	0	0	22		
VMT	0	0	704		704
Total Emissions, lbs	127	339	918	**1384**	
Total VMT, miles	180	360	4288		**4828**

Day 13

Day 13 - OPFOR				
Route	H to F	A to F		
Mileage (miles)	6	32		
Speed (mph)	8	20	PM-10	
Silt Content (%)	6.5	6.5	Totals	VMT
Tracked (M551)	290	0	290	
Vehicle Trips	39	0		
VMT	234	0		234
Tracked (M113) FOV	6	0	6	
Vehicle Trips	1	0		
VMT	6	0		6
Tracked (Eng. Equip.)	41	0	41	
Vehicle Trips	7	0		
VMT	42	0		42
Tracked (M578/M88)	25	0	25	
Vehicle Trips	2	0		
VMT	12	0		12
Wheeled (M998)	36	347	384	
Vehicle Trips	28	20		
VMT	168	640		808
Wheeled (5 ton)	0	2717	2717	
Vehicle Trips	0	30		
VMT	0	960		960
Wheeled (HEMTT)	0	2057	2057	
Vehicle Trips	0	20		
VMT	0	640		640
Wheeled (M818)	0	0	0	
Vehicle Trips	0	0		
VMT	0	0		0
Total Emissions, lbs	398	5122	**5520**	
Total VMT, miles	462	2240		**2702**

Day 14

Day 14 - OPFOR			
Route	F to A		
Mileage (miles)	32		
Speed (mph)	20	**PM-10**	
Silt Content (%)	6.5	**Totals**	**VMT**
Tracked (M551)	15450	15450	
Vehicle Trips	156		
VMT	4992		4992
Tracked (M113) FOV	1893	1893	
Vehicle Trips	24		
VMT	768		768
Tracked (Eng. Equip.)	0	0	
Vehicle Trips	0		
VMT	0		0
Tracked (M578/M88)	2132	2132	
Vehicle Trips	13		
VMT	416		416
Wheeled (M998)	1390	1390	
Vehicle Trips	80		
VMT	2560		2560
Wheeled (5 ton)	0	0	
Vehicle Trips	0		
VMT	0		0
Wheeled (HEMTT)	0	0	
Vehicle Trips	0		
VMT	0		0
Wheeled (M818)	0	0	
Vehicle Trips	0		
VMT	0		0
Total Emissions, lbs	20864	**20864**	
Total VMT, miles	8736		**8736**

OPFOR EXISTING CONDITIONS- EMISSIONS AND VMT TOTALS

Emissions in Pounds									
Vehicle Type	Day 0-6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	**Totals**
Tracked (M551)	0	12672	7830	5955	0	6657	3168	5811	2082	**44175**
Tracked (M113 FOV)	0	1558	910	769	0	368	195	760	432	**4992**
Tracked (M578/M88)	0	1740	906	853	822	1226	47	1637	844	**8075**
Tracked (Eng. Equip.)	0	0	0	0	741	497	56	595	0	**1889**
Wheeled (M998)	0	2360	494	600	325	342	327	352	2233	**7033**
Wheeled (5 Ton)	0	1636	1135	1356	568	3274	0	767	1636	**10372**
Wheeled (HEMTT)	0	1180	1289	1540	644	871	0	871	1180	**7575**
Wheeled (M818)	0	1532	975	975	975	975	975	975	1532	**8914**
Totals	0	22678	13539	12048	4075	14210	4768	11768	9939	**93025**

VMT										
Vehicle Type	Day 0-6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	**Totals**
Tracked (M551)	0	6240	3892	2960	0	3120	1560	3237	1209	**22218**
Tracked (M113 FOV)	0	960	568	480	0	230	120	548	271	**3177**
Tracked (M578/M88)	0	520	272	256	208	368	14	442	262	**2342**
Tracked (Eng. Equip.)	0	0	0	0	390	310	35	415	0	**1150**
Wheeled (M998)	0	6240	1344	1644	960	1010	870	940	6006	**19014**
Wheeled (5 Ton)	0	880	520	640	260	1480	0	320	880	**4980**
Wheeled (HEMTT)	0	560	520	640	260	320	0	320	560	**3180**
Wheeled (M818)	0	880	560	560	560	560	560	560	880	**5120**
Totals	0	16280	7676	7180	2638	7398	3159	6782	10068	**61181**

OPFOR EXISTING - VMT

Road Type Category	Paved	Desert/Hard Packed	**Totals**	
Silt Content	28	6		
Day 0 VMT	0	0	**0**	
Day 0-1 VMT	0	0	**0**	
Day 1 VMT	0	0	**0**	
Day 2 VMT	0	0	**0**	
Day 3 VMT	0	0	**0**	
Day 4 VMT	0	0	**0**	
Day 5 VMT	0	0	**0**	
Day 6 VMT	0	0	**0**	
Day 7 VMT	2035	14245	**16280**	
Day 8 VMT	170	7506	**7676**	
Day 9 VMT	170	7010	**7180**	
Day 10 VMT	170	2468	**2638**	
Day 11 VMT	270	7128	**7398**	
Day 12 VMT	380	2779	**3159**	
Day 13 VMT	725	6057	**6782**	
Day 14 VMT	1335	8733	**10068**	
Totals	5255	55926	**61181**	

Day 0-6

Day 0-6 - OPFOR							
Route							
Mileage (miles)							
Speed (mph)							
Silt Content (%)						PM-10 Totals	VMT
Tracked (M551)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Tracked (M578/M88)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Tracked (Eng. Equip.)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (M998)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (5 ton)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (HEMTT)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (M818)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Total Emissions, lbs	0	0	0	0	0	0	
Total VMT, miles	0	0	0	0	0		0

Day 7

Day 7 - OPFOR							
Route	A to X	X to M	M to N	N to B	B to C		
Mileage (miles)	5	9	9	8	9		
Speed (mph)	25	13	13	13	20	**PM-10**	
Silt Content (%)	28	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M551)	167	2824	2824	2511	4345	12672	
Vehicle Trips	156	156	156	156	156		
VMT	780	1404	1404	1248	1404		6240
Tracked (M113 FOV	26	346	346	308	532	1558	
Vehicle Trips	24	24	24	24	24		
VMT	120	216	216	192	216		960
Tracked (M578/M88)	14	390	390	346	600	1740	
Vehicle Trips	13	13	13	13	13		
VMT	65	117	117	104	117		520
Tracked (Eng. Equip.	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (M998)	167	495	495	440	762	2360	
Vehicle Trips	156	156	156	156	156		
VMT	780	1404	1404	1248	1404		6240
Wheeled (5 ton)	24	364	364	324	560	1636	
Vehicle Trips	22	22	22	22	22		
VMT	110	198	198	176	198		880
Wheeled (HEMTT)	15	263	263	234	405	1180	
Vehicle Trips	14	14	14	14	14		
VMT	70	126	126	112	126		560
Wheeled (M818)	24	341	341	303	524	1532	
Vehicle Trips	22	22	22	22	22		
VMT	110	198	198	176	198		880
Total Emissions, lbs	435	5024	5024	4466	7729	**22678**	
Total VMT, miles	2035	3663	3663	3256	3663		**16280**

Day 8

Day 8 - OPFOR									
Route	B to K	K to J	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	7	10	9	8	9	9	5		
Speed (mph)	13	13	20	13	13	13	25	**PM-10 Totals**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	28		**VMT**
Tracked (M551)	2197	5633	0	0	0	0	0	7830	
Vehicle Trips	156	280	0	0	0	0	0		
VMT	1092	2800	0	0	0	0	0		3892
Tracked (M113 FOV)	269	641	0	0	0	0	0	910	
Vehicle Trips	24	40	0	0	0	0	0		
VMT	168	400	0	0	0	0	0		568
Tracked (M578/M88)	373	533	0	0	0	0	0	906	
Vehicle Trips	16	16	0	0	0	0	0		
VMT	112	160	0	0	0	0	0		272
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Wheeled (M998)	79	113	98	56	64	64	21	494	
Vehicle Trips	32	32	20	20	20	20	20		
VMT	224	320	180	160	180	180	100		1344
Wheeled (5 ton)	258	368	509	0	0	0	0	1135	
Vehicle Trips	20	20	20	0	0	0	0		
VMT	140	200	180	0	0	0	0		520
Wheeled (HEMTT)	293	418	579	0	0	0	0	1289	
Vehicle Trips	20	20	20	0	0	0	0		
VMT	140	200	180	0	0	0	0		520
Wheeled (M818)	0	0	334	193	217	217	15	975	
Vehicle Trips	0	0	14	14	14	14	14		
VMT	0	0	126	112	126	126	70		560
Total Emissions, lbs	3468	7705	1519	249	280	280	36	**13539**	
Total VMT, miles	1876	4080	666	272	306	306	170		**7676**

Day 9

Day 9 - OPFOR										
Route	K to J	J to I	K to B	C to B	B to N	N to M	M to X	X to A	PM-10 Totals	VMT
Mileage (miles)	10	6	7	9	8	9	9	5		
Speed (mph)	13	13	13	20	13	13	13	25		
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	28		
Tracked (M551)	2816	3138	0	0	0	0	0	0	5955	
Vehicle Trips	140	260	0	0	0	0	0	0		
VMT	1400	1560	0	0	0	0	0	0		2960
Tracked (M113 FOV)	384	384	0	0	0	0	0	0	769	
Vehicle Trips	24	40	0	0	0	0	0	0		
VMT	240	240	0	0	0	0	0	0		480
Tracked (M578/M88)	533	320	0	0	0	0	0	0	853	
Vehicle Trips	16	16	0	0	0	0	0	0		
VMT	160	96	0	0	0	0	0	0		256
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Wheeled (M998)	113	135	49	98	56	64	64	21	600	
Vehicle Trips	32	64	20	20	20	20	20	20		
VMT	320	384	140	180	160	180	180	100		1644
Wheeled (5 ton)	368	221	258	509	0	0	0	0	1356	
Vehicle Trips	20	20	20	20	0	0	0	0		
VMT	200	120	140	180	0	0	0	0		640
Wheeled (HEMTT)	418	251	293	579	0	0	0	0	1540	
Vehicle Trips	20	20	20	20	0	0	0	0		
VMT	200	120	140	180	0	0	0	0		640
Wheeled (M818)	0	0	0	334	193	217	217	15	975	
Vehicle Trips	0	0	0	14	14	14	14	14		
VMT	0	0	0	126	112	126	126	70		560
Total Emissions, lbs	4633	4449	599	1519	249	280	280	36	**12047**	
Total VMT, miles	2520	2520	420	666	272	306	306	170		**7180**

Day 10

Day 10 - OPFOR										
Route	C to B	B to K	K to J	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	9	7	10	9	8	9	9	5		
Speed (mph)	20	13	13	20	13	13	13	25		
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	28	**PM-10 Totals**	**VMT**
Tracked (M551)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M578/M88)	369	187	267	0	0	0	0	0	822	
Vehicle Trips	8	8	8	0	0	0	0	0		
VMT	72	56	80	0	0	0	0	0		208
Tracked (Eng. Equip.)	333	168	240	0	0	0	0	0	741	
Vehicle Trips	15	15	15	0	0	0	0	0		
VMT	135	105	150	0	0	0	0	0		390
Wheeled (M998)	0	49	71	0	56	64	64	21	325	
Vehicle Trips	0	20	20	0	20	20	20	20		
VMT	0	140	200	0	160	180	180	100		960
Wheeled (5 ton)	255	129	184	0	0	0	0	0	568	
Vehicle Trips	10	10	10	0	0	0	0	0		
VMT	90	70	100	0	0	0	0	0		260
Wheeled (HEMTT)	289	146	209	0	0	0	0	0	644	
Vehicle Trips	10	10	10	0	0	0	0	0		
VMT	90	70	100	0	0	0	0	0		260
Wheeled (M818)	0	0	0	334	193	217	217	15	975	
Vehicle Trips	0	0	0	14	14	14	14	14		
VMT	0	0	0	126	112	126	126	70		560
Total Emissions, lbs	1246	679	970	334	249	280	280	36	**4075**	
Total VMT, miles	387	441	630	126	272	306	306	170		**2638**

Day 11

Day 11 - OPFOR										
Route	I to J	J to K	K to B	B to C	B to N	N to M	M to X	X to A		
Mileage (miles)	6	10	7	9	8	9	9	5		
Speed (mph)	13	13	13	20	13	13	13	25	**PM-10 Totals**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	28		**VMT**
Tracked (M551)	1883	3138	549	1086	0	0	0	0	6657	
Vehicle Trips	156	156	39	39	0	0	0	0		
VMT	936	1560	273	351	0	0	0	0		3120
Tracked (M113 FOV)	96	160	112	0	0	0	0	0	368	
Vehicle Trips	10	10	10	0	0	0	0	0		
VMT	60	100	70	0	0	0	0	0		230
Tracked (M578/M88)	320	533	373	0	0	0	0	0	1226	
Vehicle Trips	16	16	16	0	0	0	0	0		
VMT	96	160	112	0	0	0	0	0		368
Tracked (Eng. Equip.)	144	240	112	0	0	0	0	0	497	
Vehicle Trips	15	15	10	0	0	0	0	0		
VMT	90	150	70	0	0	0	0	0		310
Wheeled (M998)	42	71	25	0	56	64	64	21	342	
Vehicle Trips	20	20	10	0	20	20	20	20		
VMT	120	200	70	0	160	180	180	100		1010
Wheeled (5 ton)	0	0	258	2038	294	331	331	21	3274	
Vehicle Trips	0	0	20	80	20	20	20	20		
VMT	0	0	140	720	160	180	180	100		1480
Wheeled (HEMTT)	0	0	293	579	0	0	0	0	871	
Vehicle Trips	0	0	20	20	0	0	0	0		
VMT	0	0	140	180	0	0	0	0		320
Wheeled (M818)	0	0	0	334	193	217	217	15	975	
Vehicle Trips	0	0	0	14	14	14	14	14		
VMT	0	0	0	126	112	126	126	70		560
Total Emissions, lbs	2485	4142	1721	4036	544	612	612	58	**14210**	
Total VMT, miles	1302	2170	875	1377	432	486	486	270		**7398**

Day 12

Day 12 - OPFOR								
Route	K to B	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	7	9	8	9	9	5		
Speed (mph)	13	20	13	13	13	25	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	28	**Totals**	**VMT**
Tracked (M551)	0	1086	628	706	706	42	3168	
Vehicle Trips	0	39	39	39	39	39		
VMT	0	351	312	351	351	195		1560
Tracked (M113 FOV)	0	67	38	43	43	3	195	
Vehicle Trips	0	3	3	3	3	3		
VMT	0	27	24	27	27	15		120
Tracked (M578/M88)	47	0	0	0	0	0	47	
Vehicle Trips	2	0	0	0	0	0		
VMT	14	0	0	0	0	0		14
Tracked (Eng. Equip.)	56	0	0	0	0	0	56	
Vehicle Trips	5	0	0	0	0	0		
VMT	35	0	0	0	0	0		35
Wheeled (M998)	25	98	56	64	64	21	327	
Vehicle Trips	10	20	20	20	20	20		
VMT	70	180	160	180	180	100		870
Wheeled (5 ton)	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0		
VMT	0	0	0	0	0	0		0
Wheeled (HEMTT)	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0		
VMT	0	0	0	0	0	0		0
Wheeled (M818)	0	334	193	217	217	15	975	
Vehicle Trips	0	14	14	14	14	14		
VMT	0	126	112	126	126	70		560
Total Emissions, lbs	127	1584	915	1030	1030	81	**4768**	
Total VMT, miles	119	684	608	684	684	380		**3159**

Day 13

Day 13 - OPFOR								
Route	K to B	B to C	B to N	N to M	M to X	X to A		
Mileage (miles)	7	9	8	9	9	5		
Speed (mph)	13	20	13	13	13	25		
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	28	**PM-10 Totals**	**VMT**
Tracked (M551)	1648	0	1255	1412	1412	83	5811	
Vehicle Trips	117	0	78	78	78	78		
VMT	819	0	624	702	702	390		3237
Tracked (M113 FO	34	0	218	245	245	18	760	
Vehicle Trips	3	0	17	17	17	17		
VMT	21	0	136	153	153	85		548
Tracked (M578/M88	373	738	160	180	180	6	1637	
Vehicle Trips	16	16	6	6	6	6		
VMT	112	144	48	54	54	30		442
Tracked (Eng. Equip	168	0	128	144	144	11	595	
Vehicle Trips	15	0	10	10	10	10		
VMT	105	0	80	90	90	50		415
Wheeled (M998)	49	98	56	64	64	21	352	
Vehicle Trips	20	20	20	20	20	20		
VMT	140	180	160	180	180	100		940
Wheeled (5 ton)	258	509	0	0	0	0	767	
Vehicle Trips	20	20	0	0	0	0		
VMT	140	180	0	0	0	0		320
Wheeled (HEMTT)	293	579	0	0	0	0	871	
Vehicle Trips	20	20	0	0	0	0		
VMT	140	180	0	0	0	0		320
Wheeled (M818)	0	334	193	217	217	15	975	
Vehicle Trips	0	14	14	14	14	14		
VMT	0	126	112	126	126	70		560
Total Emissions, lbs	2822	2257	2010	2262	2262	155	**11768**	
Total VMT, miles	1477	810	1160	1305	1305	725		**6782**

Day 14

Day 14 - OPFOR							
Route	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	9	8	9	9	5		
Speed (mph)	20	13	13	13	25	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	28	**Totals**	**VMT**
Tracked (M551)	0	628	706	706	42	2082	
VMT	0	39	39	39	39		
VMT	0	312	351	351	195		1209
Tracked (M113 FOV)	133	90	101	101	7	432	
VMT	6	7	7	7	7		
VMT	54	56	63	63	35		271
Tracked (M578/M88)	231	187	210	210	7	844	
VMT	5	7	7	7	7		
VMT	45	56	63	63	35		262
Tracked (Eng. Equip.)	0	0	0	0	0	0	
VMT	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (M998)	635	440	495	495	167	2233	
VMT	130	156	156	156	156		
VMT	1170	1248	1404	1404	780		6006
Wheeled (5 ton)	560	324	364	364	24	1636	
VMT	22	22	22	22	22		
VMT	198	176	198	198	110		880
Wheeled (HEMTT)	405	234	263	263	15	1180	
VMT	14	14	14	14	14		
VMT	126	112	126	126	70		560
Wheeled (M818)	524	303	341	341	24	1532	
VMT	22	22	22	22	22		
VMT	198	176	198	198	110		880
Total Emissions, lbs	2488	2205	2481	2481	286	**9940**	
Total VMT, miles	1791	2136	2403	2403	1335		**10068**

BLUFOR POST LAND ACQUISITION EMISSIONS AND VMT TOTALS

Total Emissions In Pounds

Vehicle Type	Day 0	Day 0-1	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Totals
Tracked (M1A1)	10437	741	7161	0	0	2196	3266	8739	0	4685	0	5270	0	0	3513	7532	**53540**
Tracked (M2A0)	6380	453	4362	0	0	1338	1989	5323	0	2854	0	3210	0	0	2140	4626	**32675**
Tracked (M113 FOV)	10698	416	4828	0	0	1442	2725	6247	0	3076	0	3691	0	0	2509	5773	**41405**
Tracked (M109)	1994	0	0	0	0	0	1092	958	0	0	0	433	0	0	379	573	**5429**
Tracked (M578/M88)	2511	245	669	0	626	200	297	1304	508	426	0	935	935	0	320	1926	**10902**
Tracked (Eng. Equip.)	497	0	724	0	0	216	322	861	0	461	0	519	0	0	346	339	**4285**
Wheeled (M998)	7582	299	862	373	532	275	409	1095	438	856	650	1310	777	777	1217	7853	**25305**
Wheeled (2.5 Ton)	10635	503	2277	123	0	2912	123	1872	0	0	444	3215	893	893	4315	8821	**37026**
Wheeled (5 Ton)	6761	721	1079	865	865	1333	1530	916	702	1291	4280	1291	1291	1291	1732	7593	**33541**
Wheeled (HEMTT)	8851	0	2843	2357	2357	3537	4656	2399	1913	3518	2916	3518	3518	3518	4721	8808	**59430**
Tractor (10 Ton)	3498	0	0	388	388	0	0	388	388	0	388	0	388	0	388	3472	**9686**
Totals	**69844**	**3378**	**24805**	**4106**	**4768**	**13449**	**16409**	**30102**	**3949**	**17167**	**8678**	**23392**	**7802**	**6479**	**21580**	**57316**	**313224**

Total VMT

Vehicle Type	Day 0	Day 0-1	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Totals
Tracked (M1A1)	2484	172	1593	0	0	348	696	1798	0	928	0	1044	0	0	696	2204	11963
Tracked (M2A0)	2484	172	1593	0	0	348	696	1798	0	928	0	1044	0	0	696	2204	11963
Tracked (M113 FOV)	7965	301	3420	0	0	720	1818	4026	0	1920	0	2304	0	0	1566	5185	29225
Tracked (M109)	774	0	0	0	0	0	378	306	0	0	0	144	0	0	126	324	2052
Tracked (M578/M88)	919	86	228	0	204	48	96	424	176	128	0	304	304	0	96	807	3820
Tracked (Eng. Equip.)	368	0	513	0	0	108	216	558	0	288	0	324	0	0	216	304	2895
Wheeled (M998)	24666	1040	2652	1218	1710	624	1248	3224	1500	2544	2100	3972	2460	2460	3708	27142	82268
Wheeled (2.5 Ton)	10260	520	2016	180	0	2412	180	1764	0	0	648	2736	760	760	3600	8670	34506
Wheeled (5 Ton)	4585	520	726	510	510	836	860	656	440	760	2560	760	760	760	1000	5265	21508
Wheeled (HEMTT)	5250	0	1656	1224	1224	1920	2496	1488	1056	1824	1536	1824	1824	1824	2400	5250	32796
Tractor (10 Ton)	3300	0	0	540	540	0	0	540	540	0	540	0	540	0	540	3300	10380
Totals	**63055**	**2811**	**14397**	**3672**	**4188**	**7364**	**8684**	**16582**	**3712**	**9320**	**7384**	**14456**	**6648**	**5804**	**14644**	**60655**	**243376**

BLUFOR POST LAND ACQUISITION - VMT

Road Type Category	Paved	Desert/Hard Packed	**Totals**	
Silt Content	28	6.5		
Day 0 VMT	6797	56258	**63055**	
Day 0-1 VMT	345	2466	**2811**	
Day 1 VMT	0	14397	**14397**	
Day 2 VMT	0	3672	**3672**	
Day 3 VMT	0	4188	**4188**	
Day 4 VMT	0	7364	**7364**	
Day 5 VMT	0	8684	**8684**	
Day 6 VMT	0	16582	**16582**	
Day 7 VMT	0	3712	**3712**	
Day 8 VMT	0	9320	**9320**	
Day 9 VMT	0	7384	**7384**	
Day 10 VMT	0	14456	**14456**	
Day 11 VMT	0	6648	**6648**	
Day 12 VMT	0	5804	**5804**	
Day 13 VMT	0	14644	**14644**	
Day 14 VMT	4285	56370	**60655**	
Totals	11427	231949	**243376**	

Day 0 - BLUFOR						Day 0								
Route	A to J	J to K	K to B	A to X	X to M	M to N	N to B	B to V	V to U	U to Z	Z to Y	Y to R		
Mileage (miles)	8	10	7	5	9	9	8	3	5	4	6	6		
Speed (mph)	35	13	13	25	13	13	13	18	10	8	7	7	**PM-10 Totals**	
Silt Content (%)	28	6.5	6.5	28	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5		**VMT**
Tracked (M1A1)	0	0	0	58	2453	2453	2181	1132	1048	671	440	0	10437	
Vehicle Trips	0	0	0	54	54	54	54	54	54	54	27	0		
VMT	0	0	0	270	486	486	432	162	270	216	162	0		2484
Tracked (M2AO)	0	0	0	58	1494	1494	1328	690	639	409	268	0	6380	
Vehicle Trips	0	0	0	54	54	54	54	54	54	54	27	0		
VMT	0	0	0	270	486	486	432	162	270	216	162	0		2484
Tracked (M113 FOV)	0	0	0	183	2465	2465	2191	1138	1054	674	471	57	10698	
Vehicle Trips	0	0	0	171	171	171	171	171	171	171	91	11		
VMT	0	0	0	855	1539	1539	1368	513	855	684	546	66		7965
Tracked (M109)	0	0	0	19	488	488	433	225	208	133	0	0	1994	
Vehicle Trips	0	0	0	18	18	18	18	18	18	18	0	0		
VMT	0	0	0	90	162	162	144	54	90	72	0	0		774
Tracked (M578/M88)	0	0	0	20	570	570	506	263	243	156	129	54	2511	
Vehicle Trips	0	0	0	19	19	19	19	19	19	19	12	5		
VMT	0	0	0	95	171	171	152	57	95	76	72	30		919
Tracked (Eng. Equip.)	0	0	0	9	115	115	103	53	49	32	21	0	497	
Vehicle Trips	0	0	0	8	8	8	8	8	8	8	4	0		
VMT	0	0	0	40	72	72	64	24	40	32	24	0		368
Wheeled (M998)	127	251	183	479	1423	1423	1264	765	708	453	367	139	7582	
Vehicle Trips	74	74	74	448	448	448	448	522	522	522	322	122		
VMT	592	740	518	2240	4032	4032	3584	1566	2610	2088	1932	732		24666
Wheeled (2.5 ton)	17	122	89	208	2223	2223	1976	1079	999	639	633	428	10635	
Vehicle Trips	10	10	10	194	194	194	194	204	204	204	154	104		
VMT	80	100	70	970	1746	1746	1552	612	1020	816	924	624		10260
Wheeled (5 ton)	17	177	129	87	1341	1341	1192	695	644	412	422	303	6761	
Vehicle Trips	10	10	10	81	81	81	81	91	91	91	71	51		
VMT	80	100	70	405	729	729	648	273	455	364	426	306		4585
Wheeled (HEMTT)	0	0	0	109	1918	1918	1705	885	820	525	554	419	8851	
Vehicle Trips	0	0	0	102	102	102	102	102	102	102	82	62		
VMT	0	0	0	510	918	918	816	306	510	408	492	372		5250
Tractor (10 ton)	0	0	0	64	720	720	640	332	308	197	258	258	3498	
Vehicle Trips	0	0	0	60	60	60	60	60	60	60	60	60		
VMT	0	0	0	300	540	540	480	180	300	240	360	360		3300
Total Emissions, lbs	161	550	401	1294	15210	15210	13520	7258	6720	4301	3564	1658	**69845**	
Total VMT, miles	752	940	658	6045	10881	10881	9672	3909	6515	5212	5100	2490		**63055**

Day 0-1

Day 0 to 1 - BLUFOR														
Route	A to J	J to K	K to B	A to X	X to M	M to N	N to B	B to V	V to U	U to Z	Z to Y	Y to R		
Mileage (miles)	8	10	7	5	9	9	8	3	5	4	6	6		
Speed (mph)	35	13	13	25	13	13	13	18	10	8	7	7		
Silt Content (%)	28	6.5	6.5	28	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**PM-10 Totals**	**VMT**
Tracked (M1A1)	0	0	0	4	182	182	162	84	78	50	0	0	741	
Vehicle Trips	0	0	0	4	4	4	4	4	4	4	0	0		
VMT	0	0	0	20	36	36	32	12	20	16	0	0		172
Tracked (M2AO)	0	0	0	4	111	111	98	51	47	30	0	0	453	
Vehicle Trips	0	0	0	4	4	4	4	4	4	4	0	0		
VMT	0	0	0	20	36	36	32	12	20	16	0	0		172
Tracked (M113 FOV)	0	0	0	7	101	101	90	47	43	28	0	0	416	
Vehicle Trips	0	0	0	7	7	7	7	7	7	7	0	0		
VMT	0	0	0	35	63	63	56	21	35	28	0	0		301
Tracked (M109)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0	0	0	0	0		0
Tracked (M578/M88)	0	0	0	2	60	60	53	28	26	16	0	0	245	
Vehicle Trips	0	0	0	2	2	2	2	2	2	2	0	0		
VMT	0	0	0	10	18	18	16	6	10	8	0	0		86
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0	0	0	0	0		0
Wheeled (M998)	17	35	25	11	32	32	28	29	27	17	23	23	299	
Vehicle Trips	10	10	10	10	10	10	10	20	20	20	20	20		
VMT	80	100	70	50	90	90	80	60	100	80	120	120		1040
Wheeled (2.5 ton)	9	64	45	5	57	57	51	53	49	31	41	41	503	
Vehicle Trips	5	5	5	5	5	5	5	10	10	10	10	10		
VMT	40	50	35	25	45	45	40	30	50	40	60	60		520
Wheeled (5 ton)	9	92	64	5	83	83	74	76	71	45	59	59	721	
Vehicle Trips	5	5	5	5	5	5	5	10	10	10	10	10		
VMT	40	50	35	25	45	45	40	30	50	40	60	60		520
Wheeled (HEMTT)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0	0	0	0	0		0
Tractor (10 ton)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0	0	0	0	0		0
Total Emissions, lbs	34	191	134	40	625	625	556	368	341	218	123	123	3377	
Total VMT, miles	160	200	140	185	333	333	296	171	285	228	240	240		2811

Day 1 - BLUFOR				Day 1					
Route	R to Y	Y to Z	Z to U	U to V	V to O	V to C	C to AA		
Mileage (miles)	6	6	4	5	12	7	8		
Speed (mph)	7	7	8	10	15	15	15	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M1A1)	0	881	671	1048	2027	1182	1351	7161	
Vehicle Trips	0	54	54	54	29	29	29		
VMT	0	324	216	270	348	203	232		1593
Tracked (M2AO)	0	536	409	639	1235	720	823	4362	
Vehicle Trips	0	54	54	54	29	29	29		
VMT	0	324	216	270	348	203	232		1593
Tracked (M113 FOV)	0	621	473	739	1331	776	887	4828	
Vehicle Trips	0	120	120	120	60	60	60		
VMT	0	720	480	600	720	420	480		3420
Tracked (M109)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M578/M88)	0	86	66	103	185	108	123	669	
Vehicle Trips	0	8	8	8	4	4	4		
VMT	0	48	32	40	48	28	32		228
Tracked (Eng. Equip.)	0	93	71	111	200	116	133	724	
Vehicle Trips	0	18	18	18	9	9	9		
VMT	0	108	72	90	108	63	72		513
Wheeled (M998)	0	59	90	141	254	148	169	862	
Vehicle Trips	0	52	104	104	52	52	52		
VMT	0	312	416	520	624	364	416		2652
Wheeled (2.5 ton)	82	189	226	353	635	370	423	2277	
Vehicle Trips	20	46	72	72	36	36	36		
VMT	120	276	288	360	432	252	288		2016
Wheeled (5 ton)	143	131	91	142	255	149	170	1079	
Vehicle Trips	24	22	20	20	10	10	10		
VMT	144	132	80	100	120	70	80		726
Wheeled (HEMTT)	324	324	247	386	694	405	463	2843	
Vehicle Trips	48	48	48	48	24	24	24		
VMT	288	288	192	240	288	168	192		1656
Tractor (10 ton)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Total Emissions, lbs	549	2921	2343	3661	6814	3975	4543	**24805**	
Total VMT, miles	552	2532	1992	2490	3036	1771	2024		**14397**

Day 2 - BLUFOR				Day 2					
Route	R to Y	Y to Z	Z to U	U to V	V to O	V to C	C to AA		
Mileage (miles)	6	6	4	5	12	7	8		
Speed (mph)	7	7	8	10	15	15	15	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M2AO)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M109)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M578/M88)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Wheeled (M998)	23	34	35	54	68	74	85	373	
Vehicle Trips	20	30	40	40	14	26	26		
VMT	120	180	160	200	168	182	208		1218
Wheeled (2.5 ton)	82	41	0	0	0	0	0	123	
Vehicle Trips	20	10	0	0	0	0	0		
VMT	120	60	0	0	0	0	0		180
Wheeled (5 ton)	0	59	91	142	255	149	170	865	
Vehicle Trips	0	10	20	20	10	10	10		
VMT	0	60	80	100	120	70	80		510
Wheeled (HEMTT)	0	162	247	386	694	405	463	2357	
Vehicle Trips	0	24	48	48	24	24	24		
VMT	0	144	192	240	288	168	192		1224
Tractor (10 ton)	258	129	0	0	0	0	0	388	
Vehicle Trips	60	30	0	0	0	0	0		
VMT	360	180	0	0	0	0	0		540
Total Emissions, lbs	363	426	372	582	1017	628	717	**4106**	
Total VMT, miles	600	624	432	540	576	420	480		**3672**

Day 3 - BLUFOR				Day 3					
Route	R to Y	Y to Z	Z to U	U to V	V to O	V to C	C to AA		
Mileage (miles)	6	6	4	5	12	7	8		
Speed (mph)	7	7	8	10	15	15	15		
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**PM-10 Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M2AO)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M109)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M578/M88)	0	43	66	103	185	108	123	626	
Vehicle Trips	0	4	8	8	4	4	4		
VMT	0	24	32	40	48	28	32		204
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Wheeled (M998)	23	46	52	81	147	85	98	532	
Vehicle Trips	20	40	60	60	30	30	30		
VMT	120	240	240	300	360	210	240		1710
Wheeled (2.5 ton)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Wheeled (5 ton)	0	59	91	142	255	149	170	865	
Vehicle Trips	0	10	20	20	10	10	10		
VMT	0	60	80	100	120	70	80		510
Wheeled (HEMTT)	0	162	247	386	694	405	463	2357	
Vehicle Trips	0	24	48	48	24	24	24		
VMT	0	144	192	240	288	168	192		1224
Tractor (10 ton)	258	129	0	0	0	0	0	388	
Vehicle Trips	60	30	0	0	0	0	0		
VMT	360	180	0	0	0	0	0		540
Total Emissions, lbs	281	439	455	711	1280	747	853	**4767**	
Total VMT, miles	480	648	544	680	816	476	544		**4188**

Day 4 - BLUFOR	Day 4									
Route	R to Y	Y to Z	Z to U	U to V	V to O	O to P	V to AA	AA to E		
Mileage (miles)	6	6	4	5	12	3	14	9		
Speed (mph)	7	7	8	10	15	20	15	15	PM-10	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	Totals	VMT
Tracked (M1A1)	0	0	0	0	0	676	0	1520	2196	
Vehicle Trips	0	0	0	0	0	29	0	29		
VMT	0	0	0	0	0	87	0	261		348
Tracked (M2AO)	0	0	0	0	0	412	0	926	1338	
Vehicle Trips	0	0	0	0	0	29	0	29		
VMT	0	0	0	0	0	87	0	261		348
Tracked (M113 FOV)	0	0	0	0	0	444	0	998	1442	
Vehicle Trips	0	0	0	0	0	60	0	60		
VMT	0	0	0	0	0	180	0	540		720
Tracked (M109)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M578/M88)	0	0	0	0	0	62	0	138	200	
Vehicle Trips	0	0	0	0	0	4	0	4		
VMT	0	0	0	0	0	12	0	36		48
Tracked (Eng. Equip.)	0	0	0	0	0	67	0	150	216	
Vehicle Trips	0	0	0	0	0	9	0	9		
VMT	0	0	0	0	0	27	0	81		108
Wheeled (M998)	0	0	0	0	0	85	0	191	275	
Vehicle Trips	0	0	0	0	0	52	0	52		
VMT	0	0	0	0	0	156	0	468		624
Wheeled (2.5 ton)	82	189	226	353	635	212	740	476	2912	
Vehicle Trips	20	46	72	72	36	36	36	36		
VMT	120	276	288	360	432	108	504	324		2412
Wheeled (5 ton)	143	131	91	142	255	85	297	191	1333	
Vehicle Trips	24	22	20	20	10	10	10	10		
VMT	144	132	80	100	120	30	140	90		836
Wheeled (HEMTT)	324	324	247	386	694	231	810	521	3537	
Vehicle Trips	48	48	48	48	24	24	24	24		
VMT	288	288	192	240	288	72	336	216		1920
Tractor (10 ton)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Total Emissions, lbs	549	644	563	880	1584	2271	1848	5111	**13449**	
Total VMT, miles	552	696	560	700	840	759	980	2277		**7364**

Day 5

Day 5 - BLUFOR												
Route	R to Y	Y to Z	Z to U	U to V	V to O	O to P	P to Q	Q to H	V to AA	AA to E	E to F	
Mileage (miles)	6	6	4	5	12	3	3	11	14	9	10	
Speed (mph)	7	7	8	10	15	20	15	15	15	15	8	**PM-10**
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	0	0	507	1858	0	0	901	3266	
Vehicle Trips	0	0	0	0	0	0	29	29	0	0	29		
VMT	0	0	0	0	0	0	87	319	0	0	290		696
Tracked (M2AO)	0	0	0	0	0	0	309	1132	0	0	549	1989	
Vehicle Trips	0	0	0	0	0	0	29	29	0	0	29		
VMT	0	0	0	0	0	0	87	319	0	0	290		696
Tracked (M113 FOV)	0	0	71	111	399	0	333	1220	0	0	591	2725	
Vehicle Trips	0	0	18	18	18	0	60	60	0	0	60		
VMT	0	0	72	90	216	0	180	660	0	0	600		1818
Tracked (M109)	0	0	133	208	750	0	0	0	0	0	0	1092	
Vehicle Trips	0	0	18	18	18	0	0	0	0	0	0		
VMT	0	0	72	90	216	0	0	0	0	0	0		378
Tracked (M578/M88)	0	0	0	0	0	0	46	169	0	0	82	297	
Vehicle Trips	0	0	0	0	0	0	4	4	0	0	4		
VMT	0	0	0	0	0	0	12	44	0	0	40		96
Tracked (Eng. Equip.)	0	0	0	0	0	0	50	183	0	0	89	322	
Vehicle Trips	0	0	0	0	0	0	9	9	0	0	9		
VMT	0	0	0	0	0	0	27	99	0	0	90		216
Wheeled (M998)	0	0	0	0	0	0	64	233	0	0	113	409	
Vehicle Trips	0	0	0	0	0	0	52	52	0	0	52		
VMT	0	0	0	0	0	0	156	572	0	0	520		1248
Wheeled (2.5 ton)	82	41	0	0	0	0	0	0	0	0	0	123	
Vehicle Trips	20	10	0	0	0	0	0	0	0	0	0		
VMT	120	60	0	0	0	0	0	0	0	0	0		180
Wheeled (5 ton)	0	59	91	142	255	85	64	234	297	191	113	1530	
Vehicle Trips	0	10	20	20	10	10	10	10	10	10	10		
VMT	0	60	80	100	120	30	30	110	140	90	100		860
Wheeled (HEMTT)	324	324	247	386	694	231	174	636	810	521	309	4656	
Vehicle Trips	48	48	48	48	24	24	24	24	24	24	24		
VMT	288	288	192	240	288	72	72	264	336	216	240		2496
Tractor (10 ton)	0	0	0	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0	0	0	0		0
Total Emissions, lbs	406	425	542	846	2098	316	1545	5665	1107	712	2747	**16409**	
Total VMT, miles	408	408	416	520	840	102	651	2387	476	306	2170		**8684**

Day 6

Day 6 - BLUFOR														
Route	F to H	H to I	I to J	J to K	K to B	B to V	V to U	U to Z	Z to Y	Y to R	O to V	V to U		
Mileage (miles)	6	12	6	10	7	3	5	4	6	6	12	5		
Speed (mph)	8	13	13	13	13	18	10	8	7	7	15	10	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M1A1)	541	3513	1757	2928	0	0	0	0	0	0	0	0	8739	
Vehicle Trips	29	58	58	58	0	0	0	0	0	0	0	0		
VMT	174	696	348	580	0	0	0	0	0	0	0	0		1798
Tracked (M2AO)	329	2140	1070	1783	0	0	0	0	0	0	0	0	5323	
Vehicle Trips	29	58	58	58	0	0	0	0	0	0	0	0		
VMT	174	696	348	580	0	0	0	0	0	0	0	0		1798
Tracked (M113 FOV)	355	2307	1153	1922	0	0	0	0	0	0	399	111	6247	
Vehicle Trips	60	120	120	120	0	0	0	0	0	0	18	18		
VMT	360	1440	720	1200	0	0	0	0	0	0	216	90		4026
Tracked (M109)	0	0	0	0	0	0	0	0	0	0	750	208	958	
Vehicle Trips	0	0	0	0	0	0	0	0	0	0	18	18		
VMT	0	0	0	0	0	0	0	0	0	0	216	90		306
Tracked (M578/M88)	49	320	160	267	187	111	103	66	43	0	0	0	1304	
Vehicle Trips	4	8	8	8	8	8	8	8	4	0	0	0		
VMT	24	96	48	80	56	24	40	32	24	0	0	0		424
Tracked (Eng. Equip.)	53	346	173	288	0	0	0	0	0	0	0	0	861	
Vehicle Trips	9	18	18	18	0	0	0	0	0	0	0	0		
VMT	54	216	108	180	0	0	0	0	0	0	0	0		558
Wheeled (M998)	68	440	220	367	0	0	0	0	0	0	0	0	1095	
Vehicle Trips	52	104	104	104	0	0	0	0	0	0	0	0		
VMT	312	1248	624	1040	0	0	0	0	0	0	0	0		3224
Wheeled (2.5 ton)	0	0	0	0	642	381	353	226	189	82	0	0	1872	
Vehicle Trips	0	0	0	0	72	72	72	72	46	20	0	0		
VMT	0	0	0	0	504	216	360	288	276	120	0	0		1764
Wheeled (5 ton)	0	0	0	0	258	153	142	91	131	143	0	0	916	
Vehicle Trips	0	0	0	0	20	20	20	20	22	24	0	0		
VMT	0	0	0	0	140	60	100	80	132	144	0	0		656
Wheeled (HEMTT)	0	0	0	0	702	417	386	247	324	324	0	0	2399	
Vehicle Trips	0	0	0	0	48	48	48	48	48	48	0	0		
VMT	0	0	0	0	336	144	240	192	288	288	0	0		1488
Tractor (10 ton)	0	0	0	0	0	0	0	0	129	258	0	0	388	
Vehicle Trips	0	0	0	0	0	0	0	0	30	60	0	0		
VMT	0	0	0	0	0	0	0	0	180	360	0	0		540
Total Emissions, lbs	1395	9066	4533	7555	1788	1061	982	629	816	807	1149	319	**30101**	
Total VMT, miles	1098	4392	2196	3660	1036	444	740	592	900	912	432	180		**16582**

Day 7

Day 7 - BLUFOR								
Route	K to B	B to V	V to U	U to Z	Z to Y	Y to R		
Mileage (miles)	7	3	5	4	6	6		
Speed (mph)	13	18	10	8	7	7	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5		
Tracked (M1A1)	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0		
VMT	0	0	0	0	0	0		0
Tracked (M2AO)	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0		
VMT	0	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0		
VMT	0	0	0	0	0	0		0
Tracked (M109)	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0		
VMT	0	0	0	0	0	0		0
Tracked (M578/M88)	187	111	103	66	43	0	508	
Vehicle Trips	8	8	8	8	4	0		
VMT	56	24	40	32	24	0		176
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0		
VMT	0	0	0	0	0	0		0
Wheeled (M998)	148	88	81	52	46	23	438	
Vehicle Trips	60	60	60	60	40	20		
VMT	420	180	300	240	240	120		1500
Wheeled (2.5 ton)	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0		
VMT	0	0	0	0	0	0		0
Wheeled (5 ton)	258	153	142	91	59	0	702	
Vehicle Trips	20	20	20	20	10	0		
VMT	140	60	100	80	60	0		440
Wheeled (HEMTT)	702	417	386	247	162	0	1913	
Vehicle Trips	48	48	48	48	24	0		
VMT	336	144	240	192	144	0		1056
Tractor (10 ton)	0	0	0	0	129	258	388	
Vehicle Trips	0	0	0	0	30	60		
VMT	0	0	0	0	180	360		540
Total Emissions, lbs	1294	768	711	455	439	281	**3949**	
Total VMT, miles	952	408	680	544	648	480		**3712**

Day 8 - BLUFOR	Day 8									
Route	K to J	J to I	K to B	B to V	V to U	U to Z	Z to Y	Y to R		
Mileage (miles)	10	6	7	3	5	4	6	6		
Speed (mph)	13	13	13	18	10	8	7	7	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M1A1)	2928	1757	0	0	0	0	0	0	4685	
Vehicle Trips	58	58	0	0	0	0	0	0		
VMT	580	348	0	0	0	0	0	0		928
Tracked (M2AO)	1783	1070	0	0	0	0	0	0	2854	
Vehicle Trips	58	58	0	0	0	0	0	0		
VMT	580	348	0	0	0	0	0	0		928
Tracked (M113 FOV)	1922	1153	0	0	0	0	0	0	3076	
Vehicle Trips	120	120	0	0	0	0	0	0		
VMT	1200	720	0	0	0	0	0	0		1920
Tracked (M109)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M578/M88)	267	160	0	0	0	0	0	0	426	
Vehicle Trips	8	8	0	0	0	0	0	0		
VMT	80	48	0	0	0	0	0	0		128
Tracked (Eng. Equip.)	288	173	0	0	0	0	0	0	461	
Vehicle Trips	18	18	0	0	0	0	0	0		
VMT	180	108	0	0	0	0	0	0		288
Wheeled (M998)	367	220	99	59	54	35	23	0	856	
Vehicle Trips	104	104	40	40	40	40	20	0		
VMT	1040	624	280	120	200	160	120	0		2544
Wheeled (2.5 ton)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Wheeled (5 ton)	368	221	258	153	142	91	59	0	1291	
Vehicle Trips	20	20	20	20	20	20	10	0		
VMT	200	120	140	60	100	80	60	0		760
Wheeled (HEMTT)	1003	602	702	417	386	247	162	0	3518	
Vehicle Trips	48	48	48	48	48	48	24	0		
VMT	480	288	336	144	240	192	144	0		1824
Tractor (10 ton)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Total Emissions, lbs	8926	5356	1058	628	582	372	244	0	**17166**	
Total VMT, miles	4340	2604	756	324	540	432	324	0		**9320**

Day 9 - BLUFOR				Day 9					
Route	J to K	K to B	B to V	V to U	U to Z	Z to Y	Y to R		
Mileage (miles)	10	7	3	5	4	6	6		
Speed (mph)	13	13	18	10	8	7	7	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M2AO)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M109)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M578/M88)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Wheeled (M998)	212	148	88	81	52	46	23	650	
Vehicle Trips	60	60	60	60	60	40	20		
VMT	600	420	180	300	240	240	120		2100
Wheeled (2.5 ton)	0	0	0	0	0	148	296	444	
Vehicle Trips	0	0	0	0	0	36	72		
VMT	0	0	0	0	0	216	432		648
Wheeled (5 ton)	1472	1030	611	566	362	238	0	4280	
Vehicle Trips	80	80	80	80	80	40	0		
VMT	800	560	240	400	320	240	0		2560
Wheeled (HEMTT)	1003	702	417	386	247	162	0	2916	
Vehicle Trips	48	48	48	48	48	24	0		
VMT	480	336	144	240	192	144	0		1536
Tractor (10 ton)	0	0	0	0	0	129	258	388	
Vehicle Trips	0	0	0	0	0	30	60		
VMT	0	0	0	0	0	180	360		540
Total Emissions, lbs	2686	1880	1116	1033	661	723	577	**8677**	
Total VMT, miles	1880	1316	564	940	752	1020	912		**7384**

Day 10

Day 10 - BLUFOR											
Route	J to I	I to H	J to K	K to B	B to V	V to U	U to Z	Z to Y	Y to R		
Mileage (miles)	6	12	10	7	3	5	4	6	6		
Speed (mph)	13	13	13	13	18	10	8	7	7	**PM-10 Totals**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5		**VMT**
Tracked (M1A1)	1757	3513	0	0	0	0	0	0	0	5270	
Vehicle Trips	58	58	0	0	0	0	0	0	0		
VMT	348	696	0	0	0	0	0	0	0		1044
Tracked (M2AO)	1070	2140	0	0	0	0	0	0	0	3210	
Vehicle Trips	58	58	0	0	0	0	0	0	0		
VMT	348	696	0	0	0	0	0	0	0		1044
Tracked (M113 FOV)	1153	2307	0	0	120	111	0	0	0	3691	
Vehicle Trips	120	120	0	0	18	18	0	0	0		
VMT	720	1440	0	0	54	90	0	0	0		2304
Tracked (M109)	0	0	0	0	225	208	0	0	0	433	
Vehicle Trips	0	0	0	0	18	18	0	0	0		
VMT	0	0	0	0	54	90	0	0	0		144
Tracked (M578/M88)	160	0	267	187	111	103	66	43	0	935	
Vehicle Trips	8	0	8	8	8	8	8	4	0		
VMT	48	0	80	56	24	40	32	24	0		304
Tracked (Eng. Equip.)	173	346	0	0	0	0	0	0	0	519	
Vehicle Trips	18	18	0	0	0	0	0	0	0		
VMT	108	216	0	0	0	0	0	0	0		324
Wheeled (M998)	220	440	212	148	88	81	52	46	23	1310	
Vehicle Trips	104	104	60	60	60	60	60	40	20		
VMT	624	1248	600	420	180	300	240	240	120		3972
Wheeled (2.5 ton)	550	0	917	642	381	353	226	148	0	3215	
Vehicle Trips	72	0	72	72	72	72	72	36	0		
VMT	432	0	720	504	216	360	288	216	0		2736
Wheeled (5 ton)	221	0	368	258	153	142	91	59	0	1291	
Vehicle Trips	20	0	20	20	20	20	20	10	0		
VMT	120	0	200	140	60	100	80	60	0		760
Wheeled (HEMTT)	602	0	1003	702	417	386	247	162	0	3518	
Vehicle Trips	48	0	48	48	48	48	48	24	0		
VMT	288	0	480	336	144	240	192	144	0		1824
Tractor (10 ton)	0	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0	0		0
Total Emissions, lbs	5906	8747	2766	1936	1494	1383	681	458	23	**23392**	
Total VMT, miles	3036	4296	2080	1456	732	1220	832	684	120		**14456**

Day 11 - BLUFOR				Day 11						
Route	I to J	J to K	K to B	B to V	V to U	U to Z	Z to Y	Y to R		
Mileage (miles)	6	10	7	3	5	4	6	6		
Speed (mph)	13	13	13	18	10	8	7	7	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M2AO)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M109)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M578/M88)	160	267	187	111	103	66	43	0	935	
Vehicle Trips	8	8	8	8	8	8	4	0		
VMT	48	80	56	24	40	32	24	0		304
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Wheeled (M998)	127	212	148	88	81	52	46	23	777	
Vehicle Trips	60	60	60	60	60	60	40	20		
VMT	360	600	420	180	300	240	240	120		2460
Wheeled (2.5 ton)	153	255	178	106	98	63	41	0	893	
Vehicle Trips	20	20	20	20	20	20	10	0		
VMT	120	200	140	60	100	80	60	0		760
Wheeled (5 ton)	221	368	258	153	142	91	59	0	1291	
Vehicle Trips	20	20	20	20	20	20	10	0		
VMT	120	200	140	60	100	80	60	0		760
Wheeled (HEMTT)	602	1003	702	417	386	247	162	0	3518	
Vehicle Trips	48	48	48	48	48	48	24	0		
VMT	288	480	336	144	240	192	144	0		1824
Tractor (10 ton)	0	0	0	0	0	0	129	258	388	
Vehicle Trips	0	0	0	0	0	0	30	60		
VMT	0	0	0	0	0	0	180	360		540
Total Emissions, lbs	1262	2104	1473	874	809	518	480	281	**7801**	
Total VMT, miles	936	1560	1092	468	780	624	708	480		**6648**

Day 12

Day 12 - BLUFOR										
Route	I to J	J to K	K to B	B to V	V to U	U to Z	Z to Y	Y to R		
Mileage (miles)	6	10	7	3	5	4	6	6		
Speed (mph)	13	13	13	18	10	8	7	7	PM-10 Totals	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5		VMT
Tracked (M1A1)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M2AO)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M109)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M578/M88)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Wheeled (M998)	127	212	148	88	81	52	46	23	777	
Vehicle Trips	60	60	60	60	60	60	40	20		
VMT	360	600	420	180	300	240	240	120		2460
Wheeled (2.5 ton)	153	255	178	106	98	63	41	0	893	
Vehicle Trips	20	20	20	20	20	20	10	0		
VMT	120	200	140	60	100	80	60	0		760
Wheeled (5 ton)	221	368	258	153	142	91	59	0	1291	
Vehicle Trips	20	20	20	20	20	20	10	0		
VMT	120	200	140	60	100	80	60	0		760
Wheeled (HEMTT)	602	1003	702	417	386	247	162	0	3518	
Vehicle Trips	48	48	48	48	48	48	24	0		
VMT	288	480	336	144	240	192	144	0		1824
Tractor (10 ton)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Total Emissions, lbs	1102	1837	1286	763	707	452	308	23	6478	
Total VMT, miles	888	1480	1036	444	740	592	504	120		5804

Day 13 - BLUFOR					Day 13						
Route	H to I	I to J	J to K	K to B	B to V	V to U	U to Z	Z to Y	Y to R		
Mileage (miles)	12	6	10	7	3	5	4	6	6		
Speed (mph)	13	13	13	13	18	10	8	7	7	PM-10	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	Totals	VMT
Tracked (M1A1)	3513	0	0	0	0	0	0	0	0	3513	
Vehicle Trips	58	0	0	0	0	0	0	0	0		
VMT	696	0	0	0	0	0	0	0	0		696
Tracked (M2AO)	2140	0	0	0	0	0	0	0	0	2140	
Vehicle Trips	58	0	0	0	0	0	0	0	0		
VMT	696	0	0	0	0	0	0	0	0		696
Tracked (M113 FOV)	2307	0	0	202	0	0	0	0	0	2509	
Vehicle Trips	120	0	0	18	0	0	0	0	0		
VMT	1440	0	0	126	0	0	0	0	0		1566
Tracked (M109)	0	0	0	379	0	0	0	0	0	379	
Vehicle Trips	0	0	0	18	0	0	0	0	0		
VMT	0	0	0	126	0	0	0	0	0		126
Tracked (M578/M88)	320	0	0	0	0	0	0	0	0	320	
Vehicle Trips	8	0	0	0	0	0	0	0	0		
VMT	96	0	0	0	0	0	0	0	0		96
Tracked (Eng. Equip.)	346	0	0	0	0	0	0	0	0	346	
Vehicle Trips	18	0	0	0	0	0	0	0	0		
VMT	216	0	0	0	0	0	0	0	0		216
Wheeled (M998)	440	127	212	148	88	81	52	46	23	1217	
Vehicle Trips	104	60	60	60	60	60	60	40	20		
VMT	1248	360	600	420	180	300	240	240	120		3708
Wheeled (2.5 ton)	1100	550	917	642	381	353	226	148	0	4315	
Vehicle Trips	72	72	72	72	72	72	72	36	0		
VMT	864	432	720	504	216	360	288	216	0		3600
Wheeled (5 ton)	442	221	368	258	153	142	91	59	0	1732	
Vehicle Trips	20	20	20	20	20	20	20	10	0		
VMT	240	120	200	140	60	100	80	60	0		1000
Wheeled (HEMTT)	1203	602	1003	702	417	386	247	162	0	4721	
Vehicle Trips	48	48	48	48	48	48	48	24	0		
VMT	576	288	480	336	144	240	192	144	0		2400
Tractor (10 ton)	0	0	0	0	0	0	0	129	258	388	
Vehicle Trips	0	0	0	0	0	0	0	30	60		
VMT	0	0	0	0	0	0	0	180	360		540
Total Emissions, lbs	11811	1499	2499	2330	1038	961	615	544	281	**21580**	
Total VMT, miles	6072	1200	2000	1652	600	1000	800	840	480		**14644**

Day 14

Day 14 - BLUFOR																	
Route	F to H	H to I	I to J	J to A	J to K	K to B	B to V	V to U	U to Z	Z to Y	Y to R	B to N	N to M	M to X	X to A		
Mileage (miles)	6	12	6	8	10	7	3	5	4	6	6	8	9	9	5		
Speed (mph)	8	13	13	35	13	13	18	10	8	7	7	13	13	13	25	**PM-10 Totals**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	28		**VMT**
Tracked (M1A1)	2162	3513	1757	99	0	0	0	0	0	0	0	0	0	0	0	7532	
Vehicle Trips	116	58	58	58	0	0	0	0	0	0	0	0	0	0	0		
VMT	696	696	348	464	0	0	0	0	0	0	0	0	0	0	0		2204
Tracked (M2AO)	1317	2140	1070	99	0	0	0	0	0	0	0	0	0	0	0	4626	
Vehicle Trips	116	58	58	58	0	0	0	0	0	0	0	0	0	0	0		
VMT	696	696	348	464	0	0	0	0	0	0	0	0	0	0	0		2204
Tracked (M113 FOV)	1420	2307	1153	236	288	0	0	0	0	36	36	90	101	101	4	5773	
Vehicle Trips	240	120	120	138	18	0	0	0	0	7	7	7	7	7	7		
VMT	1440	1440	720	1104	180	0	0	0	0	42	42	56	63	63	35		5185
Tracked (M109)	0	0	0	31	542	0	0	0	0	0	0	0	0	0	0	573	
Vehicle Trips	0	0	0	18	18	0	0	0	0	0	0	0	0	0	0		
VMT	0	0	0	144	180	0	0	0	0	0	0	0	0	0	0		324
Tracked (M578/M88)	344	560	280	24	0	0	69	64	41	54	54	133	150	150	3	1926	
Vehicle Trips	28	14	14	14	0	0	5	5	5	5	5	5	5	5	5		
VMT	168	168	84	112	0	0	15	25	20	30	30	40	45	45	25		807
Tracked (Eng. Equip.)	95	154	77	14	0	0	0	0	0	0	0	0	0	0	0	339	
Vehicle Trips	16	8	8	8	0	0	0	0	0	0	0	0	0	0	0		
VMT	96	96	48	64	0	0	0	0	0	0	0	0	0	0	0		304
Wheeled (M998)	271	440	220	178	0	0	642	594	380	442	385	1236	1391	1391	281	7853	
Vehicle Trips	208	104	104	104	0	0	438	438	438	388	338	438	438	438	438		
VMT	1248	1248	624	832	0	0	1314	2190	1752	2328	2028	3504	3942	3942	2190		27142
Wheeled (2.5 ton)	0	382	191	43	0	0	814	754	483	531	428	1568	1764	1764	99	8821	
Vehicle Trips	0	25	25	25	0	0	154	154	154	129	104	154	154	154	154		
VMT	0	300	150	200	0	0	462	770	616	774	624	1232	1386	1386	770		8670
Wheeled (5 ton)	0	221	110	17	0	0	695	644	412	541	541	1339	1507	1507	58	7593	
Vehicle Trips	0	10	10	10	0	0	91	91	91	91	91	91	91	91	91		
VMT	0	120	60	80	0	0	273	455	364	546	546	728	819	819	455		5265
Wheeled (HEMTT)	0	0	0	0	0	0	885	820	525	554	419	1705	1918	1918	65	8808	
Vehicle Trips	0	0	0	0	0	0	102	102	102	82	62	102	102	102	102		
VMT	0	0	0	0	0	0	306	510	408	492	372	816	918	918	510		5250
Tractor (10 ton)	0	0	0	0	0	0	332	308	197	258	258	640	720	720	39	3472	
Vehicle Trips	0	0	0	0	0	0	60	60	60	60	60	60	60	60	60		
VMT	0	0	0	0	0	0	180	300	240	360	360	480	540	540	300		3300
Total Emissions, lbs	5609	9717	4858	741	830	0	3438	3184	2038	2416	2121	6712	7551	7551	550	**57314**	
Total VMT, miles	4344	4764	2382	3464	360	0	2550	4250	3400	4572	4002	6856	7713	7713	4285		**60655**

BLUFOR EXISTING CONDITIONS-EMISSIONS AND VMT TOTALS

Vehicle Type	Day 0	Day 0-1	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Totals
Tracked (M1A1)	10920	809	1971	3941	0	3660	2759	901	0	10349	0	0	1757	0	1757	9736	48560
Tracked (M2AO)	6674	494	1200	2401	0	2229	1681	549	0	6304	0	0	1070	0	1070	5960	29632
Tracked (M113 FOV)	11098	454	1294	2588	0	2403	2166	1135	1647	3405	0	0	861	0	1048	4577	32676
Tracked (M109)	2178	0	0	0	0	0	667	1021	0	0	0	0	300	0	650	352	5168
Tracked (M578/M88)	2542	268	404	807	807	615	438	123	611	2634	1753	1753	2352	2352	2952	3179	23590
Tracked (Eng. Equip.)	519	0	388	0	0	0	0	0	0	0	506	0	0	0	0	0	1413
Wheeled (M998)	7710	277	852	1099	700	1064	1125	1071	5178	1541	521	521	775	606	775	3563	27378
Wheeled (2.5 ton)	10458	464	2270	2270	343	2564	3891	3891	5045	1575	1744	1744	2294	2294	2844	2414	46105
Wheeled (5 ton)	6355	664	2082	2080	594	4078	5912	5912	2363	2243	939	939	1204	1204	1469	1176	39214
Wheeled (HEMTT)	8601	0	1350	1350	1350	1929	3124	3124	5366	1574	1759	1759	2361	2361	2962	2312	41282
Tractor (10 ton)	3251	0	2168	2168	2168	2168	2168	2168	2935	274	274	274	274	274	274	411	21249
Totals	**70306**	**3430**	**13979**	**18704**	**5962**	**20710**	**23931**	**19895**	**23145**	**29899**	**7496**	**6990**	**13248**	**9091**	**15801**	**33680**	**316267**

Total VMT

Vehicle Type	Day 0	Day 0-1	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Totals
Tracked (M1A1)	2160	160	261	522	0	551	609	290	0	2184	0	0	348	0	348	2204	9637
Tracked (M2AO)	2160	160	261	522	0	551	609	290	0	2184	0	0	348	0	348	2204	9637
Tracked (M113 FOV)	6840	280	540	1080	0	1140	1404	978	957	2294	0	0	600	0	654	5010	21777
Tracked (M109)	720	0	0	0	0	0	144	378	0	0	0	0	162	0	216	252	1872
Tracked (M578/M88)	760	80	81	162	162	144	156	60	190	860	630	630	810	810	990	1225	7750
Tracked (Eng. Equip.)	320	0	162	0	0	0	0	0	0	0	378	0	0	0	0	0	860
Wheeled (M998)	20436	740	2068	2536	1780	2588	3012	2880	15200	5112	2120	2120	2840	2360	2840	15300	83932
Wheeled (2.5 ton)	8100	370	1448	1448	180	1648	2888	2888	4104	1936	2152	2152	2584	2584	3016	4896	42394
Wheeled (5 ton)	3490	370	1016	1016	216	1848	3048	3048	1330	2064	1272	1272	1416	1416	1560	2208	26590
Wheeled (HEMTT)	4080	0	432	432	432	672	1392	1392	2660	864	1008	1008	1296	1296	1584	3200	21748
Tractor (10 ton)	2400	0	1600	1600	1600	1600	1600	1600	2280	1280	1280	1280	1280	1280	1280	1920	23880
Totals	**51466**	**2160**	**7869**	**9318**	**4370**	**10742**	**14862**	**13804**	**26721**	**18778**	**8840**	**8462**	**11684**	**9746**	**12836**	**38419**	**250077**

BLUFOR EXISTING - VMT

Road Type Category	Paved	Desert/Hard Packed	Totals
Silt Content	28	6	
Day 0 VMT	752	50714	**51466**
Day 0-1 VMT	160	2000	**2160**
Day 1 VMT	600	7269	**7869**
Day 2 VMT	600	8718	**9318**
Day 3 VMT	400	3970	**4370**
Day 4 VMT	620	10122	**10742**
Day 5 VMT	620	14242	**14862**
Day 6 VMT	620	13184	**13804**
Day 7 VMT	0	26721	**26721**
Day 8 VMT	3968	14810	**18778**
Day 9 VMT	3968	4872	**8840**
Day 10 VMT	3968	4494	**8462**
Day 11 VMT	3968	7716	**11684**
Day 12 VMT	3968	5778	**9746**
Day 13 VMT	3968	8868	**12836**
Day 14 VMT	25696	12723	**38419**
Totals	53876	196201	**250077**

Day 0 - BLUFOR				Day 0						
Route	A to J	J to K	K to B	A to X	X to M	M to N	N to B	B to C		
Mileage (miles)	8	10	7	5	9	9	8	9		
Speed (mph)	35	13	13	25	13	13	13	20	**PM-10**	
Silt Content (%)	28	6.5	6.5	6.5	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	58	2453	2453	2181	3774	10920	
Vehicle Trips	0	0	0	54	54	54	54	54		
VMT	0	0	0	270	486	486	432	486		2160
Tracked (M2AO)	0	0	0	58	1494	1494	1328	2299	6674	
Vehicle Trips	0	0	0	54	54	54	54	54		
VMT	0	0	0	270	486	486	432	486		2160
Tracked (M113 FOV)	0	0	0	183	2465	2465	2191	3793	11098	
Vehicle Trips	0	0	0	171	171	171	171	171		
VMT	0	0	0	855	1539	1539	1368	1539		6840
Tracked (M109)	0	0	0	19	488	488	433	750	2178	
Vehicle Trips	0	0	0	18	18	18	18	18		
VMT	0	0	0	90	162	162	144	162		720
Tracked (M578/M88)	0	0	0	20	570	570	506	876	2542	
Vehicle Trips	0	0	0	19	19	19	19	19		
VMT	0	0	0	95	171	171	152	171		760
Tracked (Eng. Equip.)	0	0	0	9	115	115	103	177	519	
Vehicle Trips	0	0	0	8	8	8	8	8		
VMT	0	0	0	40	72	72	64	72		320
Wheeled (M998)	127	261	183	479	1423	1423	1264	2550	7710	
Vehicle Trips	74	74	74	448	448	448	448	522		
VMT	592	740	518	2240	4032	4032	3584	4698		20436
Wheeled (2.5 ton)	17	127	89	208	2223	2223	1976	3596	10458	
Vehicle Trips	10	10	10	194	194	194	194	204		
VMT	80	100	70	970	1746	1746	1552	1836		8100
Wheeled (5 ton)	17	184	129	87	1341	1341	1192	2063	6355	
Vehicle Trips	10	10	10	81	81	81	81	81		
VMT	80	100	70	405	729	729	648	729		3490
Wheeled (HEMTT)	0	0	0	109	1918	1918	1705	2951	8601	
Vehicle Trips	0	0	0	102	102	102	102	102		
VMT	0	0	0	510	918	918	816	918		4080
Tractor (10 ton)	0	0	0	64	720	720	640	1108	3251	
Vehicle Trips	0	0	0	60	60	60	60	60		
VMT	0	0	0	300	540	540	480	540		2400
Total Emissions, lbs	161	572	401	1294	15210	15210	13520	23938	**70305**	
Total VMT, miles	752	940	658	6045	10881	10881	9672	11637		**51466**

Day 0 to 1 - BLUFOR				Day 0-1						
Route	A to J	J to K	K to B	A to X	X to M	M to N	N to B	B to C		
Mileage (miles)	8	10	7	5	9	9	8	9		
Speed (mph)	35	13	13	25	13	13	13	20	**PM-10 Totals**	
Silt Content (%)	28	6.5	6.5	28	6.5	6.5	6.5	6.5		**VMT**
Tracked (M1A1)	0	0	0	4	182	182	162	280	809	
Vehicle Trips	0	0	0	4	4	4	4	4		
VMT	0	0	0	20	36	36	32	36		160
Tracked (M2AO)	0	0	0	4	111	111	98	170	494	
Vehicle Trips	0	0	0	4	4	4	4	4		
VMT	0	0	0	20	36	36	32	36		160
Tracked (M113 FOV)	0	0	0	7	101	101	90	155	454	
Vehicle Trips	0	0	0	7	7	7	7	7		
VMT	0	0	0	35	63	63	56	63		280
Tracked (M109)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M578/M88)	0	0	0	2	60	60	53	92	268	
Vehicle Trips	0	0	0	2	2	2	2	2		
VMT	0	0	0	10	18	18	16	18		80
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Wheeled (M998)	17	35	25	11	32	32	28	98	277	
Vehicle Trips	10	10	10	10	10	10	10	20		
VMT	80	100	70	50	90	90	80	180		740
Wheeled (2.5 ton)	9	64	45	5	57	57	51	176	464	
Vehicle Trips	5	5	5	5	5	5	5	10		
VMT	40	50	35	25	45	45	40	90		370
Wheeled (5 ton)	9	92	64	5	83	83	74	255	664	
Vehicle Trips	5	5	5	5	5	5	5	10		
VMT	40	50	35	25	45	45	40	90		370
Wheeled (HEMTT)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tractor (10 ton)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Total Emissions, lbs	34	191	134	40	625	625	556	1226	3430	
Total VMT, miles	160	200	140	185	333	333	296	513		**2160**

Day 1

Day 1 - BLUFOR									
Route	C to D	D to AA	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	8	1	9	8	9	9	5		
Speed (mph)	20	15	20	13	13	13	25	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	28	**Totals**	**VMT**
Tracked (M1A1)	1802	169	0	0	0	0	0	1971	
Vehicle Trips	29	29	0	0	0	0	0		
VMT	232	29	0	0	0	0	0		261
Tracked (M2AO)	1098	103	0	0	0	0	0	1200	
Vehicle Trips	29	29	0	0	0	0	0		
VMT	232	29	0	0	0	0	0		261
Tracked (M113 FOV)	1183	111	0	0	0	0	0	1294	
Vehicle Trips	60	60	0	0	0	0	0		
VMT	480	60	0	0	0	0	0		540
Tracked (M109)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M578/M88)	369	35	0	0	0	0	0	404	
Vehicle Trips	9	9	0	0	0	0	0		
VMT	72	9	0	0	0	0	0		81
Tracked (Eng. Equip.)	355	33	0	0	0	0	0	388	
Vehicle Trips	18	18	0	0	0	0	0		
VMT	144	18	0	0	0	0	0		162
Wheeled (M998)	226	21	195	113	127	127	43	852	
Vehicle Trips	52	52	40	40	40	40	40		
VMT	416	52	360	320	360	360	200		2068
Wheeled (2.5 ton)	1128	106	353	204	229	229	21	2270	
Vehicle Trips	72	72	20	20	20	20	20		
VMT	576	72	180	160	180	180	100		1448
Wheeled (5 ton)	543	51	509	294	331	331	21	2082	
Vehicle Trips	24	24	20	20	20	20	20		
VMT	192	24	180	160	180	180	100		1016
Wheeled (HEMTT)	1234	116	0	0	0	0	0	1350	
Vehicle Trips	48	48	0	0	0	0	0		
VMT	384	48	0	0	0	0	0		432
Tractor (10 ton)	0	0	738	427	480	480	43	2168	
Vehicle Trips	0	0	40	40	40	40	40		
VMT	0	0	360	320	360	360	200		1600
Total Emissions, lbs	7938	744	1796	1038	1167	1167	128	**13978**	
Total VMT, miles	2728	341	1080	960	1080	1080	600		**7869**

Day 2 - BLUFOR	Day 2								
Route	C to D	D to AA	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	8	1	9	8	9	9	5		
Speed (mph)	20	15	20	13	13	13	25	PM-10	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	28	Totals	VMT
Tracked (M1A1)	3604	338	0	0	0	0	0	3941	
Vehicle Trips	58	58	0	0	0	0	0		
VMT	464	58	0	0	0	0	0		522
Tracked (M2AO)	2195	206	0	0	0	0	0	2401	
Vehicle Trips	58	58	0	0	0	0	0		
VMT	464	58	0	0	0	0	0		522
Tracked (M113 FOV)	2366	222	0	0	0	0	0	2588	
Vehicle Trips	120	120	0	0	0	0	0		
VMT	960	120	0	0	0	0	0		1080
Tracked (M109)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M578/M88)	738	69	0	0	0	0	0	807	
Vehicle Trips	18	18	0	0	0	0	0		
VMT	144	18	0	0	0	0	0		162
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Wheeled (M998)	452	42	195	113	127	127	43	1099	
Vehicle Trips	104	104	40	40	40	40	40		
VMT	832	104	360	320	360	360	200		2536
Wheeled (2.5 ton)	1128	106	353	204	229	229	21	2270	
Vehicle Trips	72	72	20	20	20	20	20		
VMT	576	72	180	160	180	180	100		1448
Wheeled (5 ton)	543	51	509	294	331	331	21	2082	
Vehicle Trips	24	24	20	20	20	20	20		
VMT	192	24	180	160	180	180	100		1016
Wheeled (HEMTT)	1234	116	0	0	0	0	0	1350	
Vehicle Trips	48	48	0	0	0	0	0		
VMT	384	48	0	0	0	0	0		432
Tractor (10 ton)	0	0	738	427	480	480	43	2168	
Vehicle Trips	0	0	40	40	40	40	40		
VMT	0	0	360	320	360	360	200		1600
Total Emissions, lbs	12260	1149	1796	1038	1167	1167	128	**18705**	
Total VMT, miles	4016	502	1080	960	1080	1080	600		**9318**

Day 3

Day 3 - BLUFOR									
Route	C to D	D to AA	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	8	1	9	8	9	9	5		
Speed (mph)	20	15	20	13	13	13	25	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	28	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M2AO)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M109)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Tracked (M578/M88)	738	69	0	0	0	0	0	807	
Vehicle Trips	18	18	0	0	0	0	0		
VMT	144	18	0	0	0	0	0		162
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0		0
Wheeled (M998)	87	8	195	113	127	127	43	700	
Vehicle Trips	20	20	40	40	40	40	40		
VMT	160	20	360	320	360	360	200		1780
Wheeled (2.5 ton)	313	29	0	0	0	0	0	343	
Vehicle Trips	20	20	0	0	0	0	0		
VMT	160	20	0	0	0	0	0		180
Wheeled (5 ton)	543	51	0	0	0	0	0	594	
Vehicle Trips	24	24	0	0	0	0	0		
VMT	192	24	0	0	0	0	0		216
Wheeled (HEMTT)	1234	116	0	0	0	0	0	1350	
Vehicle Trips	48	48	0	0	0	0	0		
VMT	384	48	0	0	0	0	0		432
Tractor (10 ton)	0	0	738	427	480	480	43	2168	
Vehicle Trips	0	0	40	40	40	40	40		
VMT	0	0	360	320	360	360	200		1600
Total Emissions, lbs	2916	273	934	540	607	607	86	**5962**	
Total VMT, miles	1040	130	720	640	720	720	400		**4370**

Day 4 - BLUFOR				Day 4						
Route	C to D	D to AA	AA to E	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	8	1	10	9	8	9	9	5		
Speed (mph)	20	15	15	20	13	13	13	25	**PM-10 Totals**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	28		**VMT**
Tracked (M1A1)	1802	169	1689	0	0	0	0	0	3660	
Vehicle Trips	29	29	29	0	0	0	0	0		
VMT	232	29	290	0	0	0	0	0		551
Tracked (M2AO)	1098	103	1029	0	0	0	0	0	2229	
Vehicle Trips	29	29	29	0	0	0	0	0		
VMT	232	29	290	0	0	0	0	0		551
Tracked (M113 FOV)	1183	111	1109	0	0	0	0	0	2403	
Vehicle Trips	60	60	60	0	0	0	0	0		
VMT	480	60	600	0	0	0	0	0		1140
Tracked (M109)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Tracked (M578/M88)	246	23	346	0	0	0	0	0	615	
Vehicle Trips	6	6	9	0	0	0	0	0		
VMT	48	6	90	0	0	0	0	0		144
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Wheeled (M998)	226	21	212	195	113	127	127	43	1064	
Vehicle Trips	52	52	52	40	40	40	40	40		
VMT	416	52	520	360	320	360	360	200		2588
Wheeled (2.5 ton)	1128	106	294	353	204	229	229	21	2564	
Vehicle Trips	72	72	20	20	20	20	20	20		
VMT	576	72	200	180	160	180	180	100		1648
Wheeled (5 ton)	1630	153	509	611	353	397	397	26	4078	
Vehicle Trips	72	72	24	24	24	24	24	24		
VMT	576	72	240	216	192	216	216	120		1848
Wheeled (HEMTT)	1234	116	579	0	0	0	0	0	1929	
Vehicle Trips	48	48	24	0	0	0	0	0		
VMT	384	48	240	0	0	0	0	0		672
Tractor (10 ton)	0	0	0	738	427	480	480	43	2168	
Vehicle Trips	0	0	0	40	40	40	40	40		
VMT	0	0	0	360	320	360	360	200		1600
Total Emissions, lbs	8547	801	5767	1898	1096	1233	1233	133	**20708**	
Total VMT, miles	2944	368	2470	1116	992	1116	1116	620		**10742**

Day 5 - BLUFOR				Day 5						
Route	D to E	E to F	C to D	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	11	10	8	9	8	9	9	5		
Speed (mph)	15	8	20	20	13	13	13	25		
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	28	**PM-10 Totals**	**VMT**
Tracked (M1A1)	1858	901	0	0	0	0	0	0	2759	
Vehicle Trips	29	29	0	0	0	0	0	0		
VMT	319	290	0	0	0	0	0	0		609
Tracked (M2AO)	1132	549	0	0	0	0	0	0	1681	
Vehicle Trips	29	29	0	0	0	0	0	0		
VMT	319	290	0	0	0	0	0	0		609
Tracked (M113 FOV)	1220	591	355	0	0	0	0	0	2166	
Vehicle Trips	60	60	18	0	0	0	0	0		
VMT	660	600	144	0	0	0	0	0		1404
Tracked (M109)	0	0	667	0	0	0	0	0	667	
Vehicle Trips	0	0	18	0	0	0	0	0		
VMT	0	0	144	0	0	0	0	0		144
Tracked (M578/M88)	254	185	0	0	0	0	0	0	438	
Vehicle Trips	6	9	0	0	0	0	0	0		
VMT	66	90	0	0	0	0	0	0		156
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Wheeled (M998)	233	113	174	195	113	127	127	43	1125	
Vehicle Trips	52	52	40	40	40	40	40	40		
VMT	572	520	320	360	320	360	360	200		3012
Wheeled (2.5 ton)	1163	564	1128	353	204	229	229	21	3891	
Vehicle Trips	72	72	72	20	20	20	20	20		
VMT	792	720	576	180	160	180	180	100		2888
Wheeled (5 ton)	1681	815	1630	611	353	397	397	26	5912	
Vehicle Trips	72	72	72	24	24	24	24	24		
VMT	792	720	576	216	192	216	216	120		3048
Wheeled (HEMTT)	1273	617	1234	0	0	0	0	0	3124	
Vehicle Trips	48	48	48	0	0	0	0	0		
VMT	528	480	384	0	0	0	0	0		1392
Tractor (10 ton)	0	0	0	738	427	480	480	43	2168	
Vehicle Trips	0	0	0	40	40	40	40	40		
VMT	0	0	0	360	320	360	360	200		1600
Total Emissions, lbs	8814	4335	5188	1898	1096	1233	1233	133	**23930**	
Total VMT, miles	4048	3710	2144	1116	992	1116	1116	620		**14862**

Day 6

Day 6 - BLUFOR										
Route	E to F	D to E	D to C	C to B	B to N	N to M	M to X	X to A		
Mileage (miles)	10	11	8	9	8	9	9	5		
Speed (mph)	8	15	20	20	13	13	13	25	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	28	**Totals**	**VMT**
Tracked (M1A1)	901	0	0	0	0	0	0	0	901	
Vehicle Trips	29	0	0	0	0	0	0	0		
VMT	290	0	0	0	0	0	0	0		290
Tracked (M2AO)	549	0	0	0	0	0	0	0	549	
Vehicle Trips	29	0	0	0	0	0	0	0		
VMT	290	0	0	0	0	0	0	0		290
Tracked (M113 FOV)	769	366	0	0	0	0	0	0	1135	
Vehicle Trips	78	18	0	0	0	0	0	0		
VMT	780	198	0	0	0	0	0	0		978
Tracked (M109)	333	688	0	0	0	0	0	0	1021	
Vehicle Trips	18	18	0	0	0	0	0	0		
VMT	180	198	0	0	0	0	0	0		378
Tracked (M578/M88)	123	0	0	0	0	0	0	0	123	
Vehicle Trips	6	0	0	0	0	0	0	0		
VMT	60	0	0	0	0	0	0	0		60
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0		0
Wheeled (M998)	113	179	174	195	113	127	127	43	1071	
Vehicle Trips	52	40	40	40	40	40	40	40		
VMT	520	440	320	360	320	360	360	200		2880
Wheeled (2.5 ton)	564	1163	1128	353	204	229	229	21	3891	
Vehicle Trips	72	72	72	20	20	20	20	20		
VMT	720	792	576	180	160	180	180	100		2888
Wheeled (5 ton)	815	1681	1630	611	353	397	397	26	5912	
Vehicle Trips	72	72	72	24	24	24	24	24		
VMT	720	792	576	216	192	216	216	120		3048
Wheeled (HEMTT)	617	1273	1234	0	0	0	0	0	3124	
Vehicle Trips	48	48	48	0	0	0	0	0		
VMT	480	528	384	0	0	0	0	0		1392
Tractor (10 ton)	0	0	0	738	427	480	480	43	2168	
Vehicle Trips	0	0	0	40	40	40	40	40		
VMT	0	0	0	360	320	360	360	200		1600
Total Emissions, lbs	4784	5350	4166	1898	1096	1233	1233	133	**19894**	
Total VMT, miles	4040	2948	1856	1116	992	1116	1116	620		**13804**

Day 7 - BLUFOR	Day 7					
Route	C to D	D to E	E to F	F to G		
Mileage (miles)	8	11	10	9		
Speed (mph)	20	15	8	8	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Tracked (M2AO)	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Tracked (M113 FOV)	651	671	325	0	1647	
Vehicle Trips	33	33	33	0		
VMT	264	363	330	0		957
Tracked (M109)	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Tracked (M578/M88)	205	211	103	92	611	
Vehicle Trips	5	5	5	5		
VMT	40	55	50	45		190
Tracked (Eng. Equip.)	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Wheeled (M998)	1737	1791	868	782	5178	
Vehicle Trips	400	400	400	400		
VMT	3200	4400	4000	3600		15200
Wheeled (2.5 ton)	1692	1745	846	761	5045	
Vehicle Trips	108	108	108	108		
VMT	864	1188	1080	972		4104
Wheeled (5 ton)	793	817	396	357	2363	
Vehicle Trips	35	35	35	35		
VMT	280	385	350	315		1330
Wheeled (HEMTT)	1800	1856	900	810	5366	
Vehicle Trips	70	70	70	70		
VMT	560	770	700	630		2660
Tractor (10 ton)	984	1015	492	443	2935	
Vehicle Trips	60	60	60	60		
VMT	480	660	600	540		2280
Total Emissions, lbs	7862	8107	3931	3245	**23145**	
Total VMT, miles	5688	7821	7110	6102		**26721**

Day 8 - BLUFOR			Day 8				
Route	F to H	H to I	I to J	J to K	G to A		
Mileage (miles)	6	12	6	10	32		
Speed (mph)	8	13	13	13	35	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	28	**Totals**	**VMT**
Tracked (M1A1)	1081	3513	2726	3029	0	10349	
Vehicle Trips	58	58	90	60	0		
VMT	348	696	540	600	0		2184
Tracked (M2AO)	659	2140	1660	1845	0	6304	
Vehicle Trips	58	58	90	60	0		
VMT	348	696	540	600	0		2184
Tracked (M113 FOV)	432	1403	769	801	0	3405	
Vehicle Trips	73	73	80	50	0		
VMT	438	876	480	500	0		2294
Tracked (M109)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Tracked (M578/M88)	369	1199	600	466	0	2634	
Vehicle Trips	30	30	30	14	0		
VMT	180	360	180	140	0		860
Tracked (Eng. Equip.)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (M998)	135	440	339	353	274	1541	
Vehicle Trips	104	104	160	100	40		
VMT	624	1248	960	1000	1280		5112
Wheeled (2.5 ton)	338	1100	0	0	137	1575	
Vehicle Trips	72	72	0	0	20		
VMT	432	864	0	0	640		1936
Wheeled (5 ton)	489	1590	0	0	164	2243	
Vehicle Trips	72	72	0	0	24		
VMT	432	864	0	0	768		2064
Wheeled (HEMTT)	370	1203	0	0	0	1574	
Vehicle Trips	48	48	0	0	0		
VMT	288	576	0	0	0		864
Tractor (10 ton)	0	0	0	0	274	274	
Vehicle Trips	0	0	0	0	40		
VMT	0	0	0	0	1280		1280
Total Emissions, lbs	3874	12589	6094	6494	849	**29900**	
Total VMT, miles	3090	6180	2700	2840	3968		**18778**

Day 9 - BLUFOR		Day 9			
Route	G to H	H to I	G to A		
Mileage (miles)	9	12	32		
Speed (mph)	8	13	35	**PM-10**	
Silt Content (%)	6.5	6.5	28	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M2AO)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M109)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M578/M88)	554	1199	0	1753	
Vehicle Trips	30	30	0		
VMT	270	360	0		630
Tracked (Eng. Equip.)	160	346	0	506	
Vehicle Trips	18	18	0		
VMT	162	216	0		378
Wheeled (M998)	78	169	274	521	
Vehicle Trips	40	40	40		
VMT	360	480	1280		2120
Wheeled (2.5 ton)	508	1100	137	1744	
Vehicle Trips	72	72	20		
VMT	648	864	640		2152
Wheeled (5 ton)	245	530	164	939	
Vehicle Trips	24	24	24		
VMT	216	288	768		1272
Wheeled (HEMTT)	555	1203	0	1759	
Vehicle Trips	48	48	0		
VMT	432	576	0		1008
Tractor (10 ton)	0	0	274	274	
Vehicle Trips	0	0	40		
VMT	0	0	1280		1280
Total Emissions, lbs	2099	4548	849	**7496**	
Total VMT, miles	2088	2784	3968		**8840**

Day 10 - BLUFOR		Day 10			
Route	G to H	H to I	G to A		
Mileage (miles)	9	12	32		
Speed (mph)	8	13	35	**PM-10**	
Silt Content (%)	6.5	6.5	28	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M2AO)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M109)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Tracked (M578/M88)	554	1199	0	1753	
Vehicle Trips	30	30	0		
VMT	270	360	0		630
Tracked (Eng. Equip.)	0	0	0	0	
Vehicle Trips	0	0	0		
VMT	0	0	0		0
Wheeled (M998)	78	169	274	521	
Vehicle Trips	40	40	40		
VMT	360	480	1280		2120
Wheeled (2.5 ton)	508	1100	137	1744	
Vehicle Trips	72	72	20		
VMT	648	864	640		2152
Wheeled (5 ton)	245	530	164	939	
Vehicle Trips	24	24	24		
VMT	216	288	768		1272
Wheeled (HEMTT)	555	1203	0	1759	
Vehicle Trips	48	48	0		
VMT	432	576	0		1008
Tractor (10 ton)	0	0	274	274	
Vehicle Trips	0	0	40		
VMT	0	0	1280		1280
Total Emissions, lbs	1939	4202	849	**6990**	
Total VMT, miles	1926	2568	3968		**8462**

Day 11 - BLUFOR		Day 11				
Route	G to H	H to I	I to J	G to A		
Mileage (miles)	9	12	6	32		
Speed (mph)	8	13	13	35	**PM-10 Totals**	
Silt Content (%)	6.5	6.5	6.5	28		**VMT**
Tracked (M1A1)	0	0	1757	0	1757	
Vehicle Trips	0	0	58	0		
VMT	0	0	348	0		348
Tracked (M2AO)	0	0	1070	0	1070	
Vehicle Trips	0	0	58	0		
VMT	0	0	348	0		348
Tracked (M113 FO	160	0	702	0	861	
Vehicle Trips	18	0	73	0		
VMT	162	0	438	0		600
Tracked (M109)	300	0	0	0	300	
Vehicle Trips	18	0	0	0		
VMT	162	0	0	0		162
Tracked (M578/M88	554	1199	600	0	2352	
Vehicle Trips	30	30	30	0		
VMT	270	360	180	0		810
Tracked (Eng. Equip	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Wheeled (M998)	78	339	85	274	775	
Vehicle Trips	40	80	40	40		
VMT	360	960	240	1280		2840
Wheeled (2.5 ton)	508	1100	550	137	2294	
Vehicle Trips	72	72	72	20		
VMT	648	864	432	640		2584
Wheeled (5 ton)	245	530	265	164	1204	
Vehicle Trips	24	24	24	24		
VMT	216	288	144	768		1416
Wheeled (HEMTT)	555	1203	602	0	2361	
Vehicle Trips	48	48	48	0		
VMT	432	576	288	0		1296
Tractor (10 ton)	0	0	0	274	274	
Vehicle Trips	0	0	0	40		
VMT	0	0	0	1280		1280
Total Emissions, lbs	2399	4371	5629	849	**13249**	
Total VMT, miles	2250	3048	2418	3968		**11684**

Day 12

Day 12 - BLUFOR						
Route	G to H	H to I	I to J	G to A		
Mileage (miles)	9	12	6	32		
Speed (mph)	8	13	13	35	**PM-10 Totals**	
Silt Content (%)	6.5	6.5	6.5	28		**VMT**
Tracked (M1A1)	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Tracked (M2AO)	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Tracked (M113 FOV)	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Tracked (M109)	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Tracked (M578/M88)	554	1199	600	0	2352	
Vehicle Trips	30	30	30	0		
VMT	270	360	180	0		810
Tracked (Eng. Equip.)	0	0	0	0	0	
Vehicle Trips	0	0	0	0		
VMT	0	0	0	0		0
Wheeled (M998)	78	169	85	274	606	
Vehicle Trips	40	40	40	40		
VMT	360	480	240	1280		2360
Wheeled (2.5 ton)	508	1100	550	137	2294	
Vehicle Trips	72	72	72	20		
VMT	648	864	432	640		2584
Wheeled (5 ton)	245	530	265	164	1204	
Vehicle Trips	24	24	24	24		
VMT	216	288	144	768		1416
Wheeled (HEMTT)	555	1203	602	0	2361	
Vehicle Trips	48	48	48	0		
VMT	432	576	288	0		1296
Tractor (10 ton)	0	0	0	274	274	
Vehicle Trips	0	0	0	40		
VMT	0	0	0	1280		1280
Total Emissions, lbs	1939	4202	2101	849	**9091**	
Total VMT, miles	1926	2568	1284	3968		**9746**

Day 13

Day 13 - BLUFOR							
Route	G to H	H to I	I to J	J to K	G to A		
Mileage (miles)	9	12	6	6	32		
Speed (mph)	8	13	13	13	35	**PM-10**	
Silt Content (%)	6.5	6.5	6.5	6.5	28	**Totals**	**VMT**
Tracked (M1A1)	0	0	0	1757	0	1757	
Vehicle Trips	0	0	0	58	0		
VMT	0	0	0	348	0		348
Tracked (M2AO)	0	0	0	1070	0	1070	
Vehicle Trips	0	0	0	58	0		
VMT	0	0	0	348	0		348
Tracked (M113 FOV)	0	346	0	702	0	1048	
Vehicle Trips	0	18	0	73	0		
VMT	0	216	0	438	0		654
Tracked (M109)	0	650	0	0	0	650	
Vehicle Trips	0	18	0	0	0		
VMT	0	216	0	0	0		216
Tracked (M578/M88)	554	1199	600	600	0	2952	
Vehicle Trips	30	30	30	30	0		
VMT	270	360	180	180	0		990
Tracked (Eng. Equip.)	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0		
VMT	0	0	0	0	0		0
Wheeled (M998)	78	169	169	85	274	775	
Vehicle Trips	40	40	80	40	40		
VMT	360	480	480	240	1280		2840
Wheeled (2.5 ton)	508	1100	550	550	137	2844	
Vehicle Trips	72	72	72	72	20		
VMT	648	864	432	432	640		3016
Wheeled (5 ton)	245	530	265	265	164	1469	
Vehicle Trips	24	24	24	24	24		
VMT	216	288	144	144	768		1560
Wheeled (HEMTT)	555	1203	602	602	0	2962	
Vehicle Trips	48	48	48	48	0		
VMT	432	576	288	288	0		1584
Tractor (10 ton)	0	0	0	0	274	274	
Vehicle Trips	0	0	0	0	40		
VMT	0	0	0	0	1280		1280
Total Emissions, lbs	1939	5198	2186	5629	849	**15801**	
Total VMT, miles	1926	3000	1524	2418	3968		**12836**

Day 14

Day 14 - BLUFOR												
Route	G to H	H to I	I to J	J to K	K to B	G to A	B to N	N to M	M to X	X to A	J to A		
Mileage (miles)	9	12	6	6	7	32	8	9	9	5	8		
Speed (mph)	8	13	13	13	13	35	13	13	13	25	35		
Silt Content (%)	6.5	6.5	6.5	6.5	6.5	28	6.5	6.5	6.5	28	28	**PM-10 Totals**	**VMT**
Tracked (M1A1)	0	0	0	0	2050	0	2342	2635	2635	74	0	9736	
Vehicle Trips	0	0	0	0	58	0	58	58	58	58	0		
VMT	0	0	0	0	406	0	464	522	522	290	0		2204
Tracked (M2AO)	0	0	0	0	1248	0	1427	1605	1605	74	0	5960	
Vehicle Trips	0	0	0	0	58	0	58	58	58	58	0		
VMT	0	0	0	0	406	0	464	522	522	290	0		2204
Tracked (M113 FOV)	0	0	173	0	819	425	936	1052	1052	94	27	4577	
Vehicle Trips	0	0	18	0	73	62	73	73	73	73	18		
VMT	0	0	108	0	511	1984	584	657	657	365	144		5010
Tracked (M109)	0	0	325	0	0	0	0	0	0	0	27	352	
Vehicle Trips	0	0	18	0	0	0	0	0	0	0	18		
VMT	0	0	108	0	0	0	0	0	0	0	144		252
Tracked (M578/M88)	277	600	300	300	350	34	400	450	450	19	0	3179	
Vehicle Trips	15	15	15	15	15	5	15	15	15	15	0		
VMT	135	180	90	90	105	160	120	135	135	75	0		1225
Tracked (Eng. Equip.)	0	0	0	0	0	0	0	0	0	0	0	0	
Vehicle Trips	0	0	0	0	0	0	0	0	0	0	0		
VMT	0	0	0	0	0	0	0	0	0	0	0		0
Wheeled (M998)	78	169	85	85	198	2739	56	64	64	26	0	3563	
Vehicle Trips	40	40	40	40	80	400	20	20	20	20	0		
VMT	360	480	240	240	560	12800	160	180	180	100	0		15300
Wheeled (2.5 ton)	254	550	275	275	321	740	0	0	0	0	0	2414	
Vehicle Trips	36	36	36	36	36	108	0	0	0	0	0		
VMT	324	432	216	216	252	3456	0	0	0	0	0		4896
Wheeled (5 ton)	122	265	132	132	155	370	0	0	0	0	0	1176	
Vehicle Trips	12	12	12	12	12	54	0	0	0	0	0		
VMT	108	144	72	72	84	1728	0	0	0	0	0		2208
Wheeled (HEMTT)	278	602	301	301	351	479	0	0	0	0	0	2312	
Vehicle Trips	24	24	24	24	24	70	0	0	0	0	0		
VMT	216	288	144	144	168	2240	0	0	0	0	0		3200
Tractor (10 ton)	0	0	0	0	0	411	0	0	0	0	0	411	
Vehicle Trips	0	0	0	0	0	60	0	0	0	0	0		
VMT	0	0	0	0	0	1920	0	0	0	0	0		1920
Total Emissions, lbs	1009	2186	1591	1093	5490	5198	5161	5806	5806	288	54	**33680**	
Total VMT, miles	1143	1524	978	762	2492	24288	1792	2016	2016	1120	288		**38419**

Appendix B

EXCERPTS FROM EPA GUIDANCE

The Code of Federal Regulations, title 40, chapter I, subchapter C, parts 6 and 51 are amended and part 93 is added as follows:

PART 6--[AMENDED]

1. The authority citation for part 51 continues to read as follows:

Authority: 42 U.S.C. 7401-7671q.

2. Section 6.303 is amended by reserving paragraphs (c) through (g) and revising paragraphs (a) and (b) to read as follows:

(a) The Clean Air Act, as amended in 1990, 42 U.S.C. 7476(c), requires Federal actions to conform to any State implementation plan approved or promulgated under section 110 of the Act. For EPA actions, the applicable conformity requirements specified in 40 CFR part 51, subpart W, 40 CFR part 93, subpart B, and the applicable State implementation plan must be met.

(b) In addition, with regard to wastewater treatment works subject to review under Subpart E of this part, the responsible official shall consider the air pollution control requirements specified in section 316(b) of the Clean Air Act, 42 U.S.C. 7616, and Agency implementation procedures.

PART 51--[AMENDED]

1. The authority citation for part 51 continues to read as follows:

Authority: 42 U.S.C. 7401-7671q.

2. Part 51 is amended by adding a new subpart W to read as follows:

W -- DETERMINING CONFORMITY OF GENERAL FEDERAL ACTIONS TO STATE OR FEDERAL IMPLEMENTATION PLANS

Sec.

51.850 Prohibition.
51.851 State implementation plan (SIP) revision.
51.852 Definitions.
51.853 Applicability.
51.854 Conformity analysis.
51.855 Reporting requirements.
51.856 Public participation.
51.857 Frequency of conformity determinations.
51.858 Criteria for determining conformity of general Federal actions.
51.859 Procedures for conformity determinations of general Federal actions.
51.860 Mitigation of air quality impacts.

W -- DETERMINING CONFORMITY OF GENERAL FEDERAL ACTIONS TO STATE OR FEDERAL IMPLEMENTATION PLANS

section 51.850 Prohibition.

(a) No department, agency or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve any activity which does not conform to an applicable implementation plan.

(b) A Federal agency must make a determination that a Federal action conforms to the applicable implementation plan in accordance with the requirements of this rule before the action is taken.

(c) The preceding sentence does not include Federal actions where either:

(1) A National Environmental Policy Act (NEPA) analysis was completed as evidenced by a final environmental assessment (EA), environmental impact statement (EIS), or finding of no significant impact (FONSI) that was prepared prior to the effective date of this rule, or

(2) (i) Prior to the effective date of this rule, an EA was commenced or a contract was awarded to develop the specific environmental analysis,

(ii) Sufficient environmental analysis is completed by March 15, 1994 so that the Federal agency may determine that the Federal action is in conformity with the specific requirements and the purposes of the applicable SIP pursuant to the agency's affirmative obligation under section 176(c) of the Clean Air Act (Act), and

(iii) A written determination of conformity under section 176(c) of the Act has been made by the Federal agency responsible for the Federal action by March 15, 1994.

(d) Notwithstanding any provision of this subpart, a determination that an action is in conformance with the applicable implementation plan does not exempt the action from any other requirements of the applicable implementation plan, the NEPA, or the Act.

§51.851 State implementation plan (SIP) revision.

(a) Each State must submit to the Environmental Protection Agency (EPA) a revision to its applicable implementation plan which contains criteria and procedures for assessing the conformity of Federal actions to the applicable implementation plan, consistent with this subpart. The State must submit the conformity provisions within 12 months after [insert date of publication in the Federal Register] or within 12 months of an area's designation to nonattainment, whichever date is later.

(b) The Federal conformity rules under this subpart and 40 CFR part 93, in addition to any existing applicable State requirements, establish the conformity criteria and procedures necessary to meet the Act requirements until such time as the required conformity SIP revision is approved by EPA. A State's conformity provisions must contain criteria and procedures that are no less stringent than the requirements described in this subpart. A State may establish more stringent conformity criteria and procedures only if they apply equally to non-Federal as well as Federal entities. Following EPA approval of the State conformity provisions (or a portion thereof) in a revision to the applicable SIP, the approved (or approved portion of the) State criteria and procedures would govern conformity determinations and the Federal conformity regulations contained in 40 CFR part 93 would apply only for the portion, if any, of the State's conformity provisions that is not approved by EPA. In addition, any previously applicable SIP requirements relating to conformity remain enforceable until the State revises its SIP to specifically remove them from the SIP and that revision is approved by EPA.

§51.852 Definitions.

Terms used but not defined in this part shall have the meaning given them by the Act and EPA's regulations, in that order of priority.

Affected Federal land manager means the Federal agency or the Federal official charged with direct responsibility for management of an area designated as Class I under 42 U.S.C. 7472 of the Act that is located within 100 km of the proposed Federal action.

Applicable implementation plan or applicable SIP means the portion (or portions) of the SIP or most recent revision thereof, which has been approved under section 110 of the Act, or promulgated under section 110(c) of the Act (Federal implementation plan), or promulgated or approved pursuant to regulations promulgated under section 301(d) of the Act and which implements the relevant requirements of the Act.

Areawide air quality modeling analysis means an assessment on a scale that includes the entire nonattainment or maintenance area which uses an air quality dispersion model to determine the effects of emissions on air quality.

Cause or contribute to a new violation means a Federal action that:

(1) Causes a new violation of a national ambient air quality standard (NAAQS) at a location in a nonattainment or maintenance area which would otherwise not be in violation of the standard during the future period in question if the Federal action were not taken, or

(2) Contributes, in conjunction with other reasonably foreseeable actions, to a new violation of a NAAQS at a location in a nonattainment or maintenance area in a manner that would increase the frequency or severity of the new violation.

Caused by, as used in the terms "direct emissions" and "indirect emissions," means emissions that would not otherwise occur in the absence of the Federal action.

Criteria pollutant or standard means any pollutant for which there is established a NAAQS at 40 CFR part 50.

Direct emissions means those emissions of a criteria pollutant or its precursors that are caused or initiated by the Federal action and occur at the same time and place as the action.

Emergency means a situation where extremely quick action on the part of the Federal agencies involved is needed and where the timing of such Federal activities makes it impractical to meet the requirements of this rule, such as natural disasters like hurricanes or earthquakes, civil disturbances such as terrorist acts, and military mobilizations.

Emissions budgets are those portions of the applicable SIP's projected emissions inventories that describe the levels of emissions (mobile, stationary, area, etc.) that provide for meeting reasonable further progress milestones, attainment, and/or maintenance for any criteria pollutant or its precursors.

Emission offsets, for purposes of section 51.858, are emissions reductions which are quantifiable, consistent with the applicable SIP attainment and reasonable further progress demonstrations, surplus to reductions required by, and credited to, other applicable SIP provisions, enforceable at both the State and Federal levels, and permanent within the timeframe specified by the program.

Emissions that a Federal agency has a continuing program responsibility for means emissions that are specifically caused by an agency carrying out its authorities, and does not include emissions that occur due to subsequent activities, unless such activities are required by the Federal agency. Where an agency, in performing its normal program responsibilities, takes actions itself or imposes conditions that result in air pollutant emissions by a non-Federal entity taking subsequent actions, such emissions are covered by the meaning of a continuing program responsibility.

EPA means the Environmental Protection Agency.

Federal action means any activity engaged in by a department, agency, or instrumentality of the Federal government, or any activity that a department, agency or instrumentality of the Federal government supports in any way, provides financial assistance for, licenses, permits, or approves, other than activities related to transportation plans, programs, and projects developed, funded, or approved under title 23 U.S.C. or the Federal Transit Act (49 U.S.C. 1601 et seq.). Where the Federal action is a permit, license, or other approval for some aspect of a non-Federal undertaking, the relevant activity is the part, portion, or phase or the non-Federal undertaking that requires the Federal permit, license, or approval.

Federal agency means, for purposes of this rule, a Federal department, agency, or instrumentality of the Federal government.

Increase the frequency or severity of any existing violation of any standard in any area means to cause a nonattainment area to exceed a standard more often or to cause a violation at a greater concentration than previously existed and/or would otherwise exist during the future period in question, if the project were not implemented.

Indirect emissions means those emissions of a criteria pollutant or its precursors that:

(1) Are caused by the Federal action, but may occur later in time and/or may be farther removed in distance from the action itself but are still reasonably foreseeable, and

(2) The Federal agency can practicably control and will maintain control over due to a continuing program responsibility of the Federal agency.

Local air quality modeling analysis means an assessment of localized impacts on a scale smaller than the entire nonattainment or maintenance area, including, for example, congested roadway intersections and highways or transit terminals, which uses an air quality dispersion model to determine the effects of emissions on air quality.

Maintenance area means an area with a maintenance plan approved under section 175A of the Act.

Maintenance plan means a revision to the applicable SIP, meeting the requirements of section 175A of the Act.

Metropolitan Planning Organization (MPO) is that organization designated as being responsible, together with the State, for conducting the continuing, cooperative, and comprehensive planning process under 23 U.S.C. 134 and 49 U.S.C. 1607.

Milestone has the meaning given in sections 182(g)(1) and 189(c)(1) of the Act.

National ambient air quality standards (NAAQS) are those standards established pursuant to section 109 of the Act and include standards for carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone, particulate matter (PM-10), and sulfur dioxide (SO_2).

NEPA is the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.).

Nonattainment Area (NAA) means an area designated as nonattainment under section 107 of the Act and described in 40 CFR part 81.

Precursors of a criteria pollutant are:

(1) For ozone, nitrogen oxides (NOx), unless an area is exempted from NOx requirements under section 182(f) of the Act, and volatile organic compounds (VOC) and

(2) For PM-10, those pollutants described in the PM-10 nonattainment area applicable SIP as significant contributors to the PM-10 levels.

Reasonably foreseeable emissions are projected future indirect emissions that are identified at the time the conformity determination is made; the location of such emissions is known and the emissions are quantifiable, as described and documented by the Federal agency based on its own information and after reviewing any information presented to the Federal agency.

Regionally significant action means a Federal action for which the direct and indirect emissions of any pollutant represent 10 percent or more of a nonattainment or maintenance area's emissions inventory for that pollutant.

Regional water and/or wastewater projects include construction, operation, and maintenance of water or wastewater conveyances, water or wastewater treatment facilities, and water storage reservoirs which affect a large portion of a nonattainment or maintenance area.

Total of direct and indirect emissions means the sum of direct and indirect emissions increases and decreases caused by the Federal action; i.e., the "net" emissions considering all direct and indirect emissions. The portion of emissions which are exempt or presumed to conform under section 51.853, paragraph (c), (d), (e), or (f) are not included in the "total of direct and indirect emissions." The "total of direct and indirect emissions" includes emissions of criteria pollutants and emissions of precursors of criteria pollutants.

§51.853 Applicability.

(a) Conformity determinations for Federal actions related to transportation plans, programs, and projects developed, funded, or approved under title 23 U.S.C. or the Federal Transit Act (49 U.S.C. 1601 *et seq.*) must meet the procedures and criteria of 40 CFR part 51, subpart T, in lieu of the procedures set forth in this subpart.

(b) For Federal actions not covered by paragraph (a) of this section, a conformity determination is required for each pollutant where the total of direct and indirect emissions in a nonattainment or maintenance area caused by a Federal action would equal or exceed any of the rates in paragraphs (b)(1) or (2) of this section.

(1) For purposes of paragraph (b) of this section, the following rates apply in nonattainment areas (NAAs):

	Tons/Year
Ozone (VOC's or NOx)	
Serious NAA's	50
Severe NAA's	25
Extreme NAA's	10
Other ozone NAA's outside an ozone transport region	100
Marginal and moderate NAA's inside an ozone transport region	
VOC	50
NOx	100
Carbon monoxide	
All NAA's	100
SO_2 or NO_2	
All NAA's	100
PM-10	
Moderate NAA's	100
Serious NAA's	70
Pb	

(i) Judicial and legislative proceedings.

(ii) Continuing and recurring activities such as permit renewals where activities conducted will be similar in scope and operation to activities currently being conducted.

(iii) Rulemaking and policy development and issuance.

(iv) Routine maintenance and repair activities, including repair and maintenance of administrative sites, roads, trails, and facilities.

(v) Civil and criminal enforcement activities, such as investigations, audits, inspections, examinations, prosecutions, and the training of law enforcement personnel.

(vi) Administrative actions such as personnel actions, organizational changes, debt management or collection, cash management, internal agency audits, program budget proposals, and matters relating to the administration and collection of taxes, duties and fees.

(vii) The routine, recurring transportation of materiel and personnel.

(viii) Routine movement of mobile assets, such as ships and aircraft, in home port reassignments and stations (when no new support facilities or personnel are required) to perform as operational groups and/or for repair or overhaul.

(ix) Maintenance dredging and debris disposal where no new depths are required, applicable permits are secured, and disposal will be at an approved disposal site.

(x) Actions, such as the following, with respect to existing structures, properties, facilities and lands where future activities conducted will be similar in scope and operation to activities currently being conducted at the existing structures, properties, facilities, and lands; for example, relocation of personnel, disposition of federally-owned existing structures, properties, facilities, and lands, rent subsidies, operation and maintenance cost subsidies, the exercise of receivership or conservatorship authority, assistance in purchasing structures, and the production of coins and currency.

(xi) The granting of leases, licenses such as for exports and trade, permits, and easements where activities conducted will be similar in scope and operation to activities currently being conducted.

(xii) Planning, studies, and provision of technical assistance.

(xiii) Routine operation of facilities, mobile assets and equipment.

(xiv) Transfers of ownership, interests, and titles in land, facilities, and real and personal properties, regardless of the form or method of the transfer.

(xv) The designation of empowerment zones, enterprise communities, or viticultural areas.

(xvi) Actions by any of the Federal banking agencies or the Federal Reserve Banks, including actions regarding charters, applications, notices, licenses, the supervision or examination of depository institutions or depository institution holding companies, access to the discount window, or the provision of financial services to banking organizations or to any department, agency or instrumentality of the United States.

(xvii) Actions by the Board of Governors of the Federal Reserve System or any Federal Reserve Bank to effect monetary or exchange rate policy.

(xviii) Actions that implement a foreign affairs function of the United States.

(xix) Actions (or portions thereof) associated with transfers of land, facilities, title, and real properties through an enforceable contract or lease agreement where the delivery of the deed is required to occur promptly after a specific, reasonable condition is met, such as promptly after the land is certified as meeting the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and where the Federal agency does not retain continuing authority to control emissions associated with the lands, facilities, title, or real properties.

(xx) Transfers of real property, including land, facilities, and related personal property from a Federal entity to another Federal entity and assignments of real property, including land, facilities, and related personal property from a Federal entity to another Federal entity for subsequent deeding to eligible applicants.

(xxi) Actions by the Department of the Treasury to effect fiscal policy and to exercise the borrowing authority of the United States.

(3) The following actions where the emissions are not reasonably foreseeable:

(i) Initial Outer Continental Shelf lease sales which are made on a broad scale and are followed by exploration and development plans on a project level.

(ii) Electric power marketing activities that involve the acquisition, sale and transmission of electric energy.

(4) Actions which implement a decision to conduct or carry out a conforming program such as prescribed burning actions which are consistent with a conforming land management plan.

(d) Notwithstanding the other requirements of this subpart, a conformity determination is not required for the following Federal actions (or portion thereof):

(1) The portion of an action that includes major new or modified stationary sources that require a permit under the new source review (NSR) program (section 173 of the Act) or the prevention of significant deterioration (PSD) program (title I, part C of the Act).

(2) Actions in response to emergencies or natural

disasters such as hurricanes, earthquakes, etc., which are commenced on the order of hours or days after the emergency or disaster and, if applicable, which meet the requirements of paragraph (e) of this section;

(3) Research, investigations, studies, demonstrations, or training [other than those exempted under section 51.853(c)(2)], where no environmental detriment is incurred and/or, the particular action furthers air quality research, as determined by the State agency primarily responsible for the applicable SIP;

(4) Alteration and additions of existing structures as specifically required by new or existing applicable environmental legislation or environmental regulations (e.g., hush houses for aircraft engines and scrubbers for air emissions).

(5) Direct emissions from remedial and removal actions carried out under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and associated regulations to the extent such emissions either comply with the substantive requirements of the PSD/NSR permitting program or are exempted from other environmental regulation under the provisions of CERCLA and applicable regulations issued under CERCLA.

(e) Federal actions which are part of a continuing response to an emergency or disaster under section 51.853(d)(2) and which are to be taken more than 6 months after the commencement of the response to the emergency or disaster under section 51.853(d)(2) are exempt from the requirements of this subpart only if:

(1) The Federal agency taking the actions makes a written determination that, for a specified period not to exceed an additional 6 months, it is impractical to prepare the conformity analyses which would otherwise be required and the actions cannot be delayed due to overriding concerns for public health and welfare, national security interests and foreign policy commitments; or

(2) For actions which are to be taken after those actions covered by paragraph (e)(1) of this section, the Federal agency makes a new determination as provided in paragraph (e)(1) of this section.

(f) Notwithstanding other requirements of this subpart, actions specified by individual Federal agencies that have met the criteria set forth in either paragraph (g)(1) or (g)(2) and the procedures set forth in paragraph (h) of this section are presumed to conform, except as provided in paragraph (j) of this section.

(g) The Federal agency must meet the criteria for establishing activities that are presumed to conform by fulfilling the requirements set forth in either paragraph (g)(1) or (g)(2) of this section:

(1) The Federal agency must clearly demonstrate using methods consistent with this rule that the total of direct

and indirect emissions from the type of activities which would be presumed to conform would not:

(i) Cause or contribute to any new violation of any standard in any area;

(ii) Interfere with provisions in the applicable SIP for maintenance of any standard;

(iii) Increase the frequency or severity of any existing violation of any standard in any area; or

(iv) Delay timely attainment of any standard or any required interim emission reductions or other milestones in any area including, where applicable, emission levels specified in the applicable SIP for purposes of:

(A) A demonstration of reasonable further progress;

(B) A demonstration of attainment; or

(C) A maintenance plan; or

(2) The Federal agency must provide documentation that the total of direct and indirect emissions from such future actions would be below the emission rates for a conformity determination that are established in paragraph (b) of this section, based, for example, on similar actions taken over recent years.

(h) In addition to meeting the criteria for establishing exemptions set forth in paragraphs (g)(1) or (g)(2) of this section, the following procedures must also be complied with to presume that activities will conform:

(1) The Federal agency must identify through

publication in the Federal Register its list of proposed activities that are presumed to conform and the basis for the presumptions;

(2) The Federal agency must notify the appropriate EPA Regional Office(s), State and local air quality agencies and, where applicable, the agency designated under section 174 of the Act and the MPO and provide at least 30 days for the public to comment on the list of proposed activities presumed to conform;

(3) the Federal agency must document its response to all the comments received and make the comments, response, and final list of activities available to the public upon request; and

(4) the Federal agency must publish the final list of such activities in the Federal Register.

(i) Notwithstanding the other requirements of this subpart, when the total of direct and indirect emissions of any pollutant from a Federal action does not equal or exceed the rates specified in paragraph (b) of this section, but represents 10 percent or more of a nonattainment or maintenance area's total emissions of that pollutant, the action is defined as a regionally significant action and the requirements of section 51.850 and sections 51.855-860 shall apply for the Federal action.

(j) Where an action otherwise presumed to conform under paragraph (f) of this section is a regionally significant action or does not in fact meet one of the criteria in paragraph (g)(1) of this section, that action shall not be presumed to conform and the requirements of section 51.850 and sections 51.855-860 shall apply for the Federal action.

(k) The provisions of this subpart shall apply in all nonattainment and maintenance areas.

§51.854 Conformity analysis.

Any Federal department, agency, or instrumentality of the Federal government taking an action subject to this subpart must make its own conformity determination consistent with the requirements of this subpart. In making its conformity determination, a Federal agency must consider comments from any interested parties. Where multiple Federal agencies have jurisdiction for various aspects of a project, a Federal agency may choose to adopt the analysis of another Federal agency or develop its own analysis in order to make its conformity determination.

§51.855 Reporting requirements.

(a) A Federal agency making a conformity determination under section 51.858 must provide to the appropriate EPA Regional Office(s), State and local air quality agencies and, where applicable, affected Federal land managers, the agency designated under section 174 of the Act and the MPO a 30 day notice which describes the proposed action and the Federal agency's draft conformity determination on the action.

(b) A Federal agency must notify the appropriate EPA Regional Office(s), State and local air quality agencies and, where applicable, affected Federal land managers, the agency designated under section 174 of the Clean Air Act and the MPO within 30 days after making a final conformity determination under section 51.858.

§51.856 Public participation.

(a) Upon request by any person regarding a specific Federal action, a Federal agency must make available for review its draft conformity determination under section 51.858 with supporting materials which describe the analytical methods and conclusions relied upon in making the applicability analysis and draft conformity determination.

(b) A Federal agency must make public its draft conformity determination under section 51.858 by placing a notice by prominent advertisement in a daily newspaper of general circulation in the area affected by the action and by providing 30 days for written public comment prior to taking any formal action on the draft determination. This comment period may be concurrent with any other public involvement, such as occurs in the NEPA process.

(c) A Federal agency must document its response to all the comments received on its draft conformity determination under section 51.858 and make the comments and responses available, upon request by any person regarding a specific

Federal action, within 30 days of the final conformity determination.

(d) A Federal agency must make public its final conformity determination under section 51.858 for a Federal action by placing a notice by prominent advertisement in a daily newspaper of general circulation in the area affected by the action within 30 days of the final conformity determination.

§51.857 Frequency of conformity determinations.

(a) The conformity status of a Federal action automatically lapses 5 years from the date a final conformity determination is reported under section 51.855, unless the Federal action has been completed or a continuous program has been commenced to implement that Federal action within a reasonable time.

(b) Ongoing Federal activities at a given site showing continuous progress are not new actions and do not require periodic redeterminations so long as such activities are within the scope of the final conformity determination reported under section 51.855.

(c) If, after the conformity determination is made, the Federal action is changed so that there is an increase in the total of direct and indirect emissions above the levels in section 51.853(b), a new conformity determination is required.

§51.858 Criteria for determining conformity of general

Federal actions.

(a) An action required under section 51.853 to have a conformity determination for a specific pollutant, will be determined to conform to the applicable SIP if, for each pollutant that exceeds the rates in section 51.853, paragraph (b), or otherwise requires a conformity determination due to the total of direct and indirect emissions from the action, the action meets the requirements of paragraph (c) of this section, and meets any of the following requirements:

(1) For any criteria pollutant, the total of direct and indirect emissions from the action are specifically identified and accounted for in the applicable SIP's attainment or maintenance demonstration;

(2) For ozone or nitrogen dioxide, the total of direct and indirect emissions from the action are fully offset within the same nonattainment or maintenance area through a revision to the applicable SIP or a similarly enforceable measure that effects emission reductions so that there is no net increase in emissions of that pollutant;

(3) For any criteria pollutant, except ozone and nitrogen dioxide, the total of direct and indirect emissions from the action meet the requirements:

(i) specified in paragraph (b) of this section, based on areawide air quality modeling analysis and local air quality modeling analysis, or

(ii) meet the requirements of paragraph (a)(5) and, for local air quality modeling analysis, the requirement of paragraph (b) of this section;

(4) For CO or PM-10,

(i) Where the State agency primarily responsible for the applicable SIP determines that an areawide air quality modeling analysis is not needed, the total of direct and indirect emissions from the action meet the requirements specified in paragraph (b) of this section, based on local air quality modeling analysis or

(ii) Where the State agency primarily responsible for the applicable SIP determines that an areawide air quality modeling analysis is appropriate and that a local air quality modeling analysis is not needed, the total of direct and indirect emissions from the action meet the requirements specified in paragraph (b) of this section, based on areawide modeling, or meet the requirements of paragraph (a)(5) of this section; or

(5) For ozone or nitrogen dioxide, and for purposes of paragraphs (a)(3)(ii) and (a)(4)(ii) of this section, each portion of the action or the action as a whole meets any of the following requirements:

(i) Where EPA has approved a revision to an area's attainment or maintenance demonstration after 1990 and the State makes a determination as provided in paragraph (A) or where the State makes a commitment as provided in paragraph

(B):

(A) The total of direct and indirect emissions from the action (or portion thereof) is determined and documented by the State agency primarily responsible for the applicable SIP to result in a level of emissions which, together with all other emissions in the nonattainment (or maintenance) area, would not exceed the emissions budgets specified in the applicable SIP.

(B) The total of direct and indirect emissions from the action (or portion thereof) is determined by the State agency responsible for the applicable SIP to result in a level of emissions which, together with all other emissions in the nonattainment (or maintenance) area, would exceed an emissions budget specified in the applicable SIP and the State Governor or the Governor's designee for SIP actions makes a written commitment to EPA which includes the following:

(1) A specific schedule for adoption and submittal of a revision to the SIP which would achieve the needed emission reductions prior to the time emissions from the Federal action would occur;

(2) Identification of specific measures for incorporation into the SIP which would result in a level of emissions which, together with all other emissions in the nonattainment or maintenance area, would not exceed any emissions budget specified in the applicable SIP;

(3) A demonstration that all existing applicable SIP requirements are being implemented in the area for the pollutants affected by the Federal action, and that local authority to implement additional requirements has been fully pursued;

(4) A determination that the responsible Federal agencies have required all reasonable mitigation measures associated with their action; and

(5) Written documentation including all air quality analyses supporting the conformity determination.

(C) Where a Federal agency made a conformity determination based on a State commitment under subparagraph (a)(5)(i)(B) of this paragraph, such a State commitment is automatically deemed a call for a SIP revision by EPA under section 110(k)(5) of the Act, effective on the date of the Federal conformity determination and requiring response within 18 months or any shorter time within which the State commits to revise the applicable SIP;

(ii) The action (or portion thereof), as determined by the MPO, is specifically included in a current transportation plan and transportation improvement program which have been found to conform to the applicable SIP under 40 CFR part 51, subpart T, or 40 CFR part 93, subpart A;

(iii) The action (or portion thereof) fully offsets its emissions within the same nonattainment or maintenance area through a revision to the applicable SIP or an equally enforceable measure that effects emission reductions equal to or greater than the total of direct and indirect emissions from the action so that there is no net increase in emissions of that pollutant;

(iv) Where EPA has not approved a revision to the relevant SIP attainment or maintenance demonstration since 1990, the total of direct and indirect emissions from the action for the future years [described in paragraph (d) of section 51.859] do not increase emissions with respect to the baseline emissions;

(A) The baseline emissions reflect the historical activity levels that occurred in the geographic area affected by the proposed Federal action during:

(1) Calendar year 1990,

(2) The calendar year that is the basis for the classification (or, where the classification is based on multiple years, the most representative year), if a classification is promulgated in 40 CFR part 81, or

(3) The year of the baseline inventory in the PM-10 applicable SIP;

(B) The baseline emissions are the total of direct and indirect emissions calculated for the future years [described in paragraph (d) of section 51.859] using the historic activity levels [described in subparagraph (a)(5)(iv)(A) of this paragraph] and appropriate emission factors for the future years; or

(v) Where the action involves regional water and/or wastewater projects, such projects are sized to meet only the needs of population projections that are in the applicable SIP.

(b) The areawide and/or local air quality modeling analyses must:

(1) Meet the requirements in section 51.859 and

(2) Show that the action does not:

(i) Cause or contribute to any new violation of any standard in any area; or

(ii) Increase the frequency or severity of any existing violation of any standard in any area.

(c) Notwithstanding any other requirements of this section, an action subject to this subpart may not be determined to conform to the applicable SIP unless the total of direct and indirect emissions from the action is in compliance or consistent with all relevant requirements and milestones contained in the applicable SIP, such as elements identified as part of the reasonable further progress schedules, assumptions specified in the attainment or maintenance demonstration, prohibitions, numerical emission limits, and work practice requirements.

(d) Any analyses required under this section must be completed, and any mitigation requirements necessary for a finding of conformity must be identified before the determination of conformity is made.

§51.859 Procedures for conformity determinations of general Federal actions.

(a) The analyses required under this subpart must be based on the latest planning assumptions.

(1) All planning assumptions must be derived from the estimates of population, employment, travel, and congestion most recently approved by the MPO, or other agency authorized to make such estimates, where available.

(2) Any revisions to these estimates used as part of the conformity determination, including projected shifts in geographic location or level of population, employment, travel, and congestion, must be approved by the MPO or other agency authorized to make such estimates for the urban area.

(b) The analyses required under this subpart must be based on the latest and most accurate emission estimation techniques available as described below, unless such techniques are inappropriate. If such techniques are inappropriate and written approval of the EPA Regional Administrator is obtained for any modification or substitution, they may be modified or another technique substituted on a case-by-case basis or, where appropriate, on a generic basis for a specific Federal agency program.

(1) For motor vehicle emissions, the most current version of the motor vehicle emissions model specified by EPA and available for use in the preparation or revision of SIPs in that State must be used for the conformity analysis

as specified below:

(i) The EPA must publish in the Federal Register a notice of availability of any new motor vehicle emissions model; and

(ii) A grace period of three months shall apply during which the motor vehicle emissions model previously specified by EPA as the most current version may be used. Conformity analyses for which the analysis was begun during the grace period or no more than 3 years before the Federal Register notice of availability of the latest emission model may continue to use the previous version of the model specified by EPA.

(2) For non-motor vehicle sources, including stationary and area source emissions, the latest emission factors specified by EPA in the "Compilation of Air Pollutant Emission Factors (AP-42)" must be used for the conformity analysis unless more accurate emission data are available, such as actual stack test data from stationary sources which are part of the conformity analysis.

(c) The air quality modeling analyses required under this Subpart must be based on the applicable air quality models, data bases, and other requirements specified in the most recent version of the "Guideline on Air Quality Models (Revised)" (1986), including supplements (EPA publication no. 450/2-78-027R), unless:

(1) The guideline techniques are inappropriate, in

which case the model may be modified or another model substituted on a case-by-case basis or, where appropriate, on a generic basis for a specific Federal agency program; and

(2) Written approval of the EPA Regional Administrator is obtained for any modification or substitution.

(d) The analyses required under this subpart, except section 51.858, paragraph (a)(1), must be based on the total of direct and indirect emissions from the action and must reflect emission scenarios that are expected to occur under each of the following cases:

(1) The Act mandated attainment year or, if applicable, the farthest year for which emissions are projected in the maintenance plan;

(2) The year during which the total of direct and indirect emissions from the action is expected to be the greatest on an annual basis; and

(3) any year for which the applicable SIP specifies an emissions budget.

§51.860 Mitigation of air quality impacts.

(a) Any measures that are intended to mitigate air quality impacts must be identified and the process for implementation and enforcement of such measures must be described, including an implementation schedule containing explicit timelines for implementation.

(b) Prior to determining that a Federal action is in conformity, the Federal agency making the conformity determination must obtain written commitments from the appropriate persons or agencies to implement any mitigation measures which are identified as conditions for making conformity determinations.

(c) Persons or agencies voluntarily committing to mitigation measures to facilitate positive conformity determinations must comply with the obligations of such commitments.

(d) In instances where the Federal agency is licensing, permitting or otherwise approving the action of another governmental or private entity, approval by the Federal agency must be conditioned on the other entity meeting the mitigation measures set forth in the conformity determination.

(e) When necessary because of changed circumstances, mitigation measures may be modified so long as the new mitigation measures continue to support the conformity determination. Any proposed change in the mitigation measures is subject to the reporting requirements of section 51.856 and the public participation requirements of section 51.857.

(f) The implementation plan revision required in section 51.851 of this subpart shall provide that written commitments to mitigation measures must be obtained prior to a positive conformity determination and that such commitments must be fulfilled.

(g) After a State revises its SIP to adopt its general conformity rules and EPA approves that SIP revision, any agreements, including mitigation measures, necessary for a conformity determination will be both State and federally enforceable. Enforceability through the applicable SIP will apply to all persons who agree to mitigate direct and indirect emissions associated with a Federal action for a conformity determination.

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